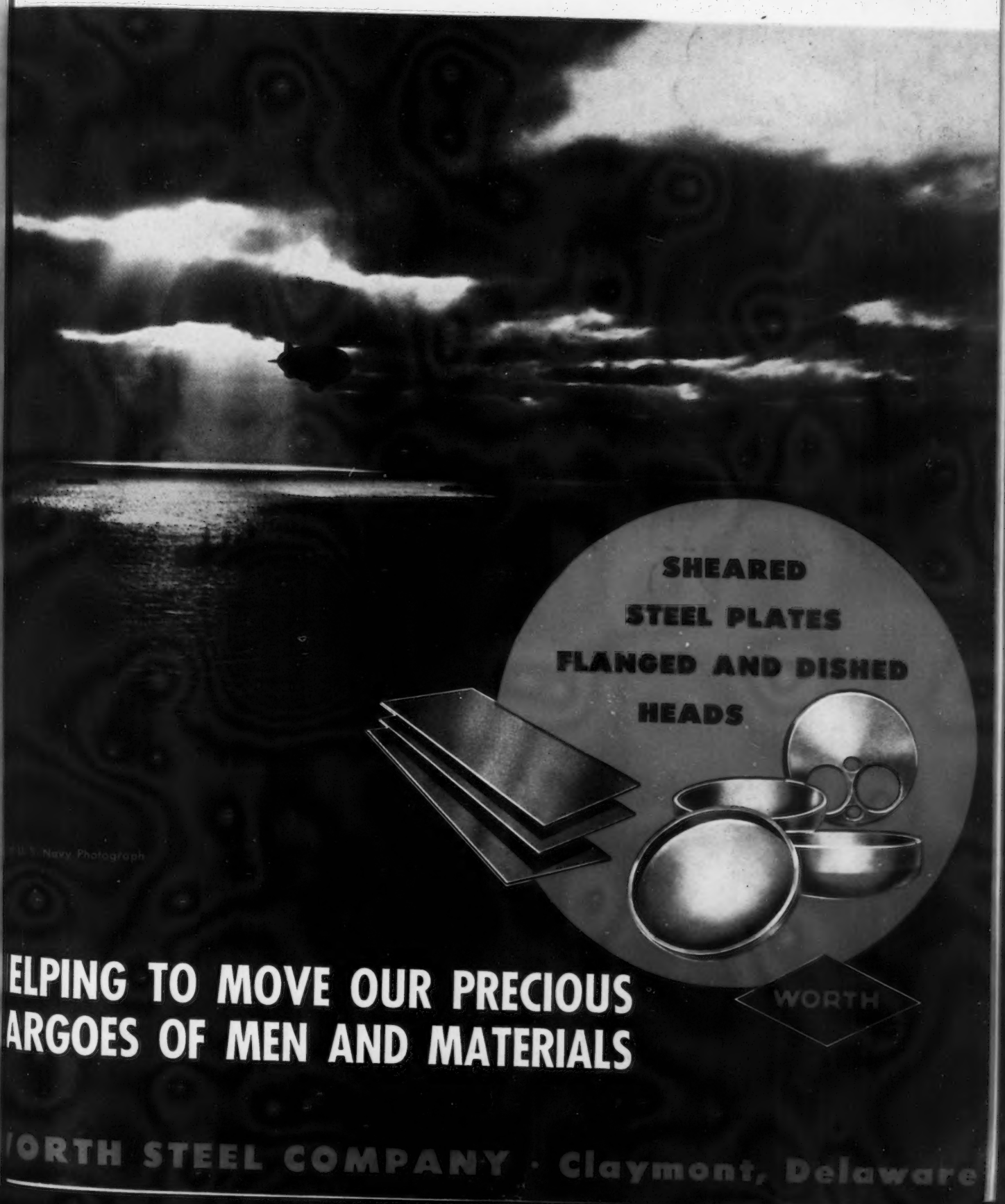
OCTOBER 28, 1943

The IRON AGE



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This Week in The IRON AGE

Vol. 152, No. 18 — October 28, 1943

Editorial

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Technical Articles

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Features

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News and Markets

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1,000,000 WITH STEEL
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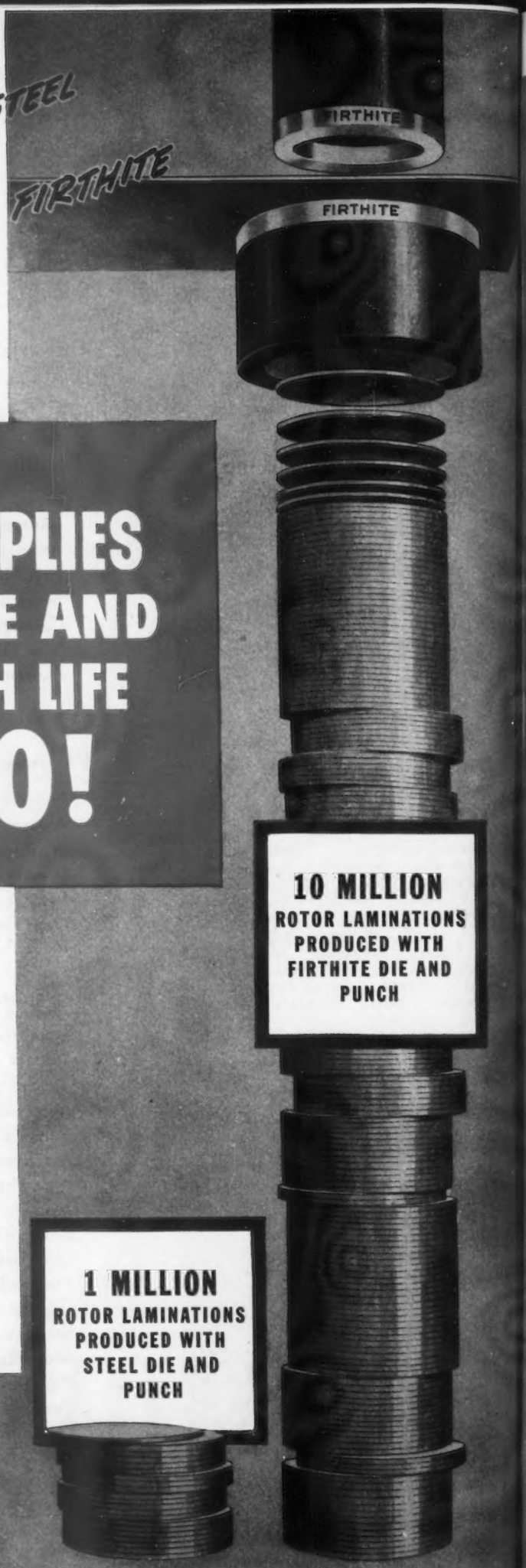

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Oct. 28, 1943

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Time's a Wastin'

Food Priority Is Planned for War Workers

U. S. Agencies' Committee Set Up to See That Extra Ration Is Given in Plants

By The United Press

WASHINGTON, Oct. 14.—Preference will be given to industrial workers under food distribution plans announced tonight by the War Food Administration.

The W. F. A. set up a special inter-agency committee to administer the program and "provide food needed by industrial workers to assure the highest efficiency in production."

The W. F. A. said industrial feeding, the provision of food on the job, is "believed to be the practical method of food distribution and control to assure adequate consumption of food by industrial workers, and will, in many instances, meet any need for increased ration allowances."

The new committee will recommend and advise on controversies affecting development of industrial feeding...

THE IRON AGE

JANUARY 21, 1943

ESTABLISHED 1855

Putting the Ratio in Rations

CONFRONTED with a critical shortage of manpower, the men of industry and government have introduced broad, sweeping changes in employment and training policies. Presidential decree 9802 set up the policy for the United States at war the hiring of Negroes. The War Manpower Commission prophesies that by the end of 1942 six million men will be employed in war industries.

While every effort is being made to increase the number of war workers, the nation's production effort may in a few months be slowly sapped of its vitality. The quart of milk a day promised to every member of the genius home when victory is ours is not sufficient stimulus for our labor force to break production records. Tantalizing visions do not supply driving energy.

To stay alive the average adult requires 2400 calories a day. But a steel worker, for example, must have 3000 extra calories an hour for each hour that he works. Assuming he works an eight-hour day, he must consume a total of 4800 calories daily if he is expected to work every working day. Light work requires 75 calories an hour above the base of 1500 for each hour worked and moderate work 150.

The problem of nutrition is not as simple as just calorie intake. Not only energy must be supplied to the living organism, but building materials as well just as an open hearth could produce no steel if only coke were supplied, so the human body cannot sustain itself without the proper proportions of iron, calcium, protein, carbohydrates, fats and vitamins.

The problem of achieving higher and higher production rates is no less vital that we cannot afford to overlook even one facet of its complexity. The human factor is always with us. It is foolish to assume that continued materials and manpower regulations alone can solve production problems. A whispered rumor that faulty materials are being supplied the armed forces is enough to start a Congressional investigation which will have management sit quietly by while their workers become less and less efficient because no recognition had been made of the greatest food requirements of laborers as compared with sedentary workers!

England has met and solved this problem by differential rationing. There, shop canteens and cafeteria serving persons doing heavy work are allotted in some cases as much as 50 per cent more food per person under the point rationing system.

The OPA is loath to start such realistic rationing for fear of political and economic repercussions. Admittedly this is no simple problem, but winning a war cannot be reduced to simple formulae. Ignoring a problem does not solve it. The food rationing division has said that at present its attitude is satisfactory but what may develop in the way of shortages causes them some concern. Without doubt the OPA is sincere in its attitude, but reasoning should be used as for preferential rationing, as a crutch after the damage is done. And as for shortage prevarications, if this practice is followed, and it is, for the men in the armed forces, it can certainly be applied for the men doing the next most strenuous work, the work of producing for war.

J. H. VanDeventer

. . . It's not considered nice to say "I told you so," but for the life of us we cannot see why it took nine months for our price and rationing authorities to recognize that the chap who shovels five to ten tons of material per day needs more calories than the guy who twiddles a pencil. Well, better late than never.

J. H. VanDeventer

Inland Steel Completes Fifty Years of Service

Founded in 1893

Eight men gathered around a table in Chicago on the afternoon of October 30, 1893—fifty years ago. They were men who saw and understood the needs of the rapidly growing Prairie Empire.

They had come together to found the Inland Steel Company, to purchase a dismantled rolling mill, to place it in operation during a period of war panic and business stagnation. After months of effort the mill was started and in the first year 5,600 tons were rolled into many useful forms for steel-hungry industry and agriculture.

Years passed—some in peace and plenty, others in war or depression. Steadily the little company forged ahead in the quality and the acceptance of its products. Land soon was acquired at Indiana Harbor, where Inland constructed its first open hearth furnaces and rolling mills. Expansion continued—blast furnaces, coke ovens, continuous mills, ore mines, coal mines, a limestone quarry, a fleet of freighters, a thoroughly equipped metallurgical laboratory—until Inland Steel Company was in full control of essential basic materials and the quality of all its many steel products. Production had climbed to 3,300,000 tons annually. Then came World War II.

Almost over night Inland, with modern mills and thousands of skilled steelmakers, turned to provide the steel to defend our country—to win against aggression. Today, fifty years after its founding, Inland is sending its entire output to men who fight. When peace comes Inland again will send steel to men who build.

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The IRON AGE
OCT. 28, 1943

NEWS FRONT

• Very soon the tin plate order, M-81, will be tightened further, to force sizable quantities of cans from hot dip bodies and electrolytic ends, to electrolytic bodies and chemically treated ends.

• Meanwhile: Canada has just eased restrictions, and will again permit tin canning of soups, mincemeat, pork and beans, spaghetti, and a number of other items, all still cut out of the American market, except by special appeal.

• About 45,000,000 more cans per year will go to Canada from U. S. to take care of this new load.

• Canada's action is dictated to keep women in war plants by easing the load of home meal preparation.

• Likely WPB will recognize the necessity for can makers to accumulate larger inventories of electrolytic and chemically treated plate, as both require enameling and baking one or more times. Baking equipment is limited and couldn't possibly handle peak packing loads, which sometimes pile up dramatically because of weather variations.

• The War Food Administration is making stringent demands for farm machinery and implements, and also for tinplate for the 1944 food pack, with the demand higher, item for item, than ever before.

• When the Italian battleship Roma was reported sunk by German dive bombers, aviation enthusiasts, commentators, etc., etc., all rushed in again to point out that aircraft this time really polished off a capital ship with bombs. Now the German News Agency admits the sinking was carried out by torpedo-bombers.

• Practically none of the Regia Aeronautica (Italian Air Force) has come over to the Allies. Most Italian airmen are fanatic Fascists, and like Goering, Mussolini pampered his "most pure and beloved creation" with better pay, quick promotions and resplendent uniforms. Furthermore, Italian airmen have no use for Badoglio, who for years tried to curtail their privileges and incorporate them into the army.

• Ships leaving Stockholm, Sweden, are given an "electrical massage" by passing them through a high-voltage field at a demagnetization station. Similar stations are planned for the southern and western coasts of that country. While complete demagnetization of the great mass of steel in a ship is not practicable, the "massage", together with the conventional de-Gaussing cable outside the hull, is said to protect a vessel adequately against magnetic mines.

• The approximate value of surplus inventory held by one West Coast airframe manufacturer, who is now attempting to dispose of it, runs into eight figures. This is more than Southern California industry plus all Pacific Navy establishments can absorb under present priority ratings, and it is only a prologue to coming material releases by four other big airframe producers, half a dozen smaller ones, the Navy, Maritime Commission, and Army.

• Contrary to original plans, the Kaiser Fontana blast furnace continues to require 25,000 tons of scrap per month, sizable quantities of it shipped by rail from as far as Portland, Ore., 1200 miles away.

• National Lead Co. will be offering ferro-vanadium to the industry in slightly more than a year from now, source of the alloy being the titanium-vanadium-iron ore from the recently re-opened MacIntyre property in Essex County, N. Y. Entry into the ferro-vanadium field is not a war baby, but will be continued after the war.

• With Weirton Steel Co. switching a continuous mill to the rolling of some 25,000 tons of brass monthly, a number of cartridge case (machine gun) manufacturers are now shifting from steel cases back to brass.

• U. S. casualties on all fronts since Pearl Harbor have been 105,205, of which 20,104 are deaths. In the same period, industrial accidents claimed 80,000 dead, 7,000,000 injured.

• Fortress crew members not only wear armored vests as protection against shrapnel, but have been strewing the vests around on the floor, in the bombadier's greenhouse, etc. Consequently, large armored blankets will soon be made available for throwing around in a Fortress as crew experience dictates. The British so far have shown little enthusiasm for this type of supplementary or personnel armor.

M. A. GROSSMANN, director of research, Chicago district, Carnegie-Illinois Steel Corp., was elected president of the American Society for Metals for the coming year.

Post-War Effects

. . . The effects of the metallurgical and engineering developments on post-war production and markets came up for close study at the 25th National Metal Congress and Exposition.

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Chicago

• • • **Metallurgists** last week debated whether developments arising from the exigencies of war would be sufficiently adhesive to form a bond with the nation's post-war economy and came to the conclusion that many would stick. Sessions and displays of the 25th National Metal Congress and Exposition drew about 10,000 technicians and operators of American and Canadian metal working industries, eager to find better and more rapid methods to win the battles of war production and, if possible, get a peek at the quiet vistas of a peaceful future.

The war, of course, brought into sharp focus currently pressing problems, but those for the most part have been solved and those in attendance were anxious to see what is believed to lie ahead. The mighty accomplishments of American industry in the past three years have been accompanied by new and complex problems, a free interchange of ideas which has been one of the outstanding characteristics of the organizations participating in the Metal Show. These organizations, the American Society for Metals; the American Institute of Mining and Metallurgical Engineers' Iron and Steel and Institute of Metals divisions; the American Welding Society; and the Wire Association, have all been the instruments through which such information could be channeled to those requiring it. The technical programs and discussions were planned, and have been for the past two years, to disseminate as much of such information and "know how" as possible.

The display sections of the Metal Show, from the exhibitors' standpoint, were well handled in spite of almost insurmountable obstacles. It was clearly evident that exhibiting equipment in the display rooms of the Palmer House was extremely unsatisfactory, but credit is due manufacturers having displays for the manner in which they handled a bad situation. Limited in what could be shown, exhibitors concentrated on distributing sales and technical literature on their products and in having in attendance technical experts of such products so that visitors might get direct and accurate answers to operating and technical questions.

The technical meetings of the four organizations as well as the War Production, Conservation and Post-War Planning meetings of the ASM, on the whole, broke attendance records. Many of the papers dealt with practical every-day operating practices, with discussions attentively followed by those in attendance.

The 18th annual Edward de Mille Campbell Memorial Lecture of the American Society for Metals was delivered this year by Dr. C. H. Mathewson, professor of metallurgy, Yale University. Dr. Mathewson's paper, "*Strain Hardening and Recrystallization*," was outstanding from the point of offering to the theoretical metallurgist new fields for investigations into stress and strains on the crystal structures of metals. His review of past work on this subject was unusually thorough. His own investigations in this field and conclusions that he reached will likely lead to renewed vigor in interest in the subject and may lead to the development of a new tool in the hands of the metallurgist in the constant endeavor to explore more thoroughly strain factors and their potentialities in metals. Because Dr. Mathewson was required to leave the convention immediately, the Edward de Mille Campbell Memorial Lecture Certificate was presented to him by ASM president, H. J. French, at the conclusion of his paper.

ASM Banquet

The president of the American Society for Metals for the coming year will be Marcus A. Grossmann, director of research, Chicago district, Carnegie-Illinois Steel Corp. While the office is not without considerable responsibility, the election of Dr. Grossmann was the ASM's way of expressing its appreciation for Dr. Grossmann's contributions to the society and for his extraordinary achievements in the field of metallurgical research. Dr. Kent R. Van Horn, research metallurgist of the Aluminum Co. of America, Cleveland, succeeds Dr. Grossmann as vice-president of the ASM.

As in previous years, the presentation of awards for outstanding work in the metals industries was one of

# of War Developments Studied

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the features of the ASM banquet. H. J. French, retiring president, presided over the award ceremonies.

Two newly created ASM medals were presented for the first time this year, both for achievements in the metallurgical field. The gold medal, awarded to Dr. Zay Jeffries, technical director of the Lamp Division of General Electric Co., was awarded for outstanding metallurgical knowledge and great versatility in the application of science to the metal industry.

The ASM medal for the advancement of research was awarded to Roy A. Hunt, president of Aluminum Co. of America. This award was established for honoring an executive in an industrial organization in the metal working field who has consistently sponsored metallurgical research or development.

Charles H. Herty, Jr., assistant to Vice-President, Bethlehem Steel Co., won the Albert Sauveur award, but was not present to receive it. The Henry Marion Howe Medal for the best paper published during the past year in the ASM transactions was awarded to Shadburn Marshall research metallurgist, Remington Arms Co., Bridgeport.

AIME Meetings

The A.I.M.E. combined its regional and annual fall meetings, with the regional program being held Oct. 16 to 18 and the annual national portion of the program extending from Oct. 18 to 20. Principal interest in the regional meetings was directed to four papers on magnesium production. The Pidgeon process was discussed by R. L. Sebastian of the WPB; Basic Magnesium Co.'s operations in Nevada were described by T. C. Russell, general superintendent, and C. P. Donohoe, assistant superintendent of the Nevada operations; and the Hansgirg process of reducing magnesium, in use in the United States only at the Kaiser Permanente plant in California, was described by T. A. Dungan, chief process manager. Present and post-war uses of magnesium and the market potentialities for this metal came under considerable discussion after they were outlined by Frank G. Breyer, Singmaster & Breyer, New York.

The board of directors of A.I.M.E. awarded the 1944 Anthony F. Lucas Gold Medal to Charles V. Millikan, chief petroleum engineer of the Amerada Petroleum Corp., Tulsa, Okla., for his outstanding contributions to engineering in the development and production of petroleum. Mr. Millikan is the sixth winner of this award, the first having been made to J. Edgar Pew, vice-president of Sun Oil Co., in 1937. The William Lawrence Saunders Gold Medal for distinguished achievement in mining was awarded George B. Harrington, president of the Chicago, Wilmington, and Franklin Coal Co., Chicago. Mr. Harrington is the 14th recipient of this award which was established in 1927.

One of the high points of the Institute of Metals division program was a symposium on the practical aspects of diffusion, covering a wide variety of problems and results of recent studies. Gas metal diffusion in metal fabricating processes, de-gassing of metals, diffusion in relation to changes in microstructure, and diffusion in Alclad 24ST sheet, in indium plating and in chromizing were studied. In addition, a session on physical metallurgy dealt with such phases as metallography with the electron microscope, the structure of copper-zinc alloys oxidized at elevated temperatures, and the rupture properties of copper at temperatures around 400 deg. F.

In conjunction with the regional program, the Iron and Steel division presented sessions on refractories and the economics of the new western steel plants. Jointly with the Institute of Metals division, a symposium on cohesive strength was conducted. Another symposium, on deep drawing, and four papers on hardenability rounded out the program.

The annual Fall dinner of the Institute of Metals and the Iron and Steel division were combined this year with the Regional Meeting dinner, with William B. Stout, president of the Stout Research division of Consolidated Aircraft Corp. as principal speaker. H. W. Graham, director of metallurgy and research, Jones & Laughlin Steel Corp., and chairman of the Iron and Steel Division; Cyrus S. Smith, chairman of the Institute of Metals division; and H. M. St. John, chairman of the Chicago session, also addressed A.I.M.E. members and dinner guests.

H. J. FRENCH, director of alloy steel and iron development of International Nickel Co., is the retiring president of the American Society for Metals.

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Welding Society

David Arnott, chief surveyor of the American Bureau of Shipping, New York, was elected president of the American Welding Society for the coming year at the society's 24th annual meeting. Mr. Arnott, who has been active in the society since its early days, particularly in its technical activities relating to ship welding, has delivered a number of papers and was the author of the society's first edition of *Welding Handbook*. The Miller Medal was awarded to Mr. Arnott in 1941 for conspicuous contributions to the art and science of marine welding.

His activities with the Bureau of Shipping for the past 23 years have gone far in earning for welding the standing that it now has. The application of welding in marine construc-

SHADBURN MARSHALL, research engineer of Remington Arms Co., Bridgeport, Conn. He was awarded the Henry Marion Howe medal of the ASM.

ZAY JEFFRIES, technical director of the lamp department of General Electric Co. He was the winner of the new ASM Gold Medal Award.

ROY A. HUNT, president of the Aluminum Co. of America, Pittsburgh. He was awarded the new ASM medal for Advancement of Research.

tion was a gradual evolution until in 1927 full classification for all-welded vessels was made possible by the Bureau of Shipping. Mr. Arnott succeeds Klaus L. Hansen, consulting engineer, Harnischfeger Corp., Milwaukee, as AWS president.

Isaac Harter, vice-president of Babcock & Wilcox Co., Barberton, Ohio, was named first vice-president of the AWS. His interest in welding dates back to 1907 when he experimented with repairing steel castings with a carbon arc. His investigations of caustic embrittlement prior to World War I led to radical revisions of the boiler water treatment in the U. S. Navy and extensive research on the effects of sodium sulphate in this field. He was active in establishing the American Society of Mechanic Engineers Boiler Code and in gaining acceptance of the Navy of welded pressure vessels.

A. C. Weigel, vice-president of Combustion Engineering Co., Inc., New York, was elected 2nd vice-president of the Welding Society. In addition to being a member of the society and its executive committee, Mr. Weigel is a member of the A.S.M.E. Boiler Code Committee, various other technical organizations, and for the past two years has served as chairman of the AWS publications committee.

American Welding Society directors at large elected were: H. W. Pierce, assistant to general manager, New York Shipbuilding Corp., Camden, N. J.; E. R. Seabloom, supervision engineer, research and development laboratories, Crane Co., Chicago; K. V. King, material engineer, Standard Oil Co. of California, San Francisco; and J. H. Deppeler, chief engineer, Metals and Thermit Corp., New York.

District vice-presidents chosen by the AWS included F. C. Fyke, Standard Oil Development Co., Elizabeth, N. J.; C. H. Jennings, Westinghouse Electric & Mfg. Co., East Pittsburgh; G. N. Sieger, S-M-S Corp., Detroit; E. C. Chapman, Hedges-Walsh-Weidner division, Combustion Engineering Co., Inc., Chattanooga, Tenn.; and J. C. Gowing, Hobart Bros., Los Angeles.

Dr. David S. Jacobus, past president of the AWS and one of the real "deans" of the welding industry, was the recipient of this year's Samuel Wylie Miller Memorial Award for his outstanding contributions over the period of many years to the art and science of welding. Dr. Jacobus, now retired, gained reknown in connection with his work as chairman of the executive committee of the Boiler Code Committee. Now nearly 82 years old, he has actively followed the developments of welding and was instrumental in bringing about more liberal rules dealing with welded pressure vessels, so that there is now no limitation on the use of welding for any thickness or size of pressure vessels providing the welding is properly done and meets required tests.

Long affiliated with Babcock & Wilcox Co., he cooperated in tests made in 1929 at the B & W plant at Barberton, Ohio, on fusion welded vessels under intermittent pressures. These tests demonstrated the dependability of properly made fusion welds and established the working stresses which

CHARLES H. HERTY, JR., assistant to the vice president, Bethlehem Steel Co. Mr. Herty was the recipient of the Albert Sauveur Achievement Award, ASM.

KLAUS L. HANSEN, consulting engineer, Harnischfeger Corp., Milwaukee, was president of the American Welding Society during the past year.

ISAAC HARTER, vice president of Babcock & Wilcox Co., Barberton, Ohio, was elected vice president of the American Welding Society.

DAVID ARNOTT, American Bureau of Shipping, New York, was elected president of the American Welding Society.

could safely be used. After these tests, the Navy issued specifications for fusion welded drums, including the requirement that the main seams be X-rayed, and the Boiler Code Committee published proposed specifications for fusion welded drums or shells of power boilers.

KENT R. VAN HORN, research metallurgist of Aluminum Co. of America, Cleveland, was elected vice president of the ASM for 1943-44.

In accepting the Miller award, Dr. Jacobus mentioned that Mr. Miller was in the class of 1887 at Stevens Institute of Technology and Dr. Jacobus was one of his instructors. He mentioned Mr. Miller's work in preparing Air Pressure Tank Safety orders which were adopted by the A.S.M.E. in its first edition of Unfired Pressure Vessel Code.

The Lincoln Gold Medal Award presented annually by the American Welding Society was awarded this year jointly to Drs. Gilvert E. Doan, Robert D. Stout, and John H. Frye, Jr., all of whom are associated with Lehigh University. The award was made to these men for their development of the so-called Lehigh System of predicting ductility of weldments.

For outstanding papers presented on welding during the past year, three Resistance Welder Manufacturers Association prizes were presented by AWS. W. F. Hess, assistant professor in metallurgical engineering and head of the welding laboratory at Rensselaer Polytechnic Institute was the recipient of one of these awards for his outstanding contributions to welding both in the form of technical papers presented before the society and for the work he has done in welding research.

Richard Della-Vedowa, Lockheed Aircraft Corp., Burbank, Calif., and Mabel Rockwell, Lockheed Aircraft Corp., were also recipients of Resistance Welder Manufacturers Association prizes this year.

Wire Association

Flint C. Elder, special research engineer of American Steel & Wire Co., Cleveland, delivered the Wire Association's Mordica Memorial Lecture this year, his paper being entitled: "The Wire Drawing Die." The technical sessions of the Wire Association this year fell generally into two classifications, the first being on wire drawing problems from the mill standpoint and the other being the use of substitute materials in covering wire. Two papers worthy of note in the former class were those by John C. Aiken, Jones & Laughlin Steel Corp., and by Rodman R. Tatnall, Wickwire Spencer Steel Co. Mr. Aiken's paper dealt with drawing practices in the manufacture of wire for steel wire rope, and Mr. Tatnall's paper concerned brittleness resulting from hydrogen in spring steels.

The matter of substitute materials in place of those formerly used but now on government critical lists for covering wire was discussed at some length. Lead base coatings as a substitute for zinc, glass insulations, vinyl resins for wire and cable covering, electrical insulating tapes, and coating wire with synthetic compounds by extrusion, were the subjects of the several papers presented that were devoted to this phase of wire production.

Strain-Hardening

Dr. C. H. MATHEWSON

1943 Edward de Mille Campbell Memorial Lecturer. Dr. Mathewson is professor of Metallurgy at Yale University and is the 18th Campbell Lecturer.

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By C. H. MATHEWSON
Yale University

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"IN 1920 Edward DeMille Campbell, professor of chemistry and director of the chemical laboratory of the University of Michigan, became a charter member of the Detroit Chapter of the American Society for Steel Treating. In April, 1921, he was elected to honorary membership, being the fourth person to receive this distinction. He died on September 18, 1925. On December 5, 1925, the American Society for Steel Treating, seeking to commemorate his achievements, established the E. D. Campbell Lecture. The first E. D. Campbell lecture was given in Chicago a year ago by Dr. William Minot Guertler of Charlottenberg, Germany," and Dr. Zay Jeffries, in 1927, concluded this paragraph by acknowledging the privilege of presenting the second lecture. Last year's lecture by Professor John Chipman was the seventeenth of the series.

I have chosen the subject of strain hardening and recrystallization for this lecture because in my own thinking it lies at the root of the extraordinary versatility of our common metals and alloys. Whatever we do to them in mill or shop practice provokes a response in the form of strain; a certain disturbance and readjustment of the atoms within their structural frame of crystallinity. Much is known about crystal structure, slip systems, macroscopic movements of the material in bulk, empirical microstructures, rates of change from one observed state to another, size of precipitated or fragmented particles produced by heat treatment or plastic deformation and there is an enormous accumulation of data on strength properties as related to specified conditions or treatments, X-ray evaluations of lattice changes, such as line displacement or broadening, but no general understanding of changes in the pattern of atomic interplay which must be responsible for the major effects, and these are indeed miracles or transformation. We seem to accept with feeble imagination the fact that a metal may be doubled in strength by merely changing its shape! Perhaps I have underestimated the thought which has gone into this bottomless pit because leaders of our science and technology have been constrained to express opinions, reaching all the way from Tammann's bold assumption of "an unknown change in the atoms" through an interlude of slip interference (Jeffries) reconstructed by Taylor into a form of interference by one system of crystal faults with the propagation of another set, to the more generalized assumption that strain-hardening is hardening or resistance to slip due to some strained configuration of the atomic arrangement, not necessarily restricted to an imperfect lattice.

The confusion of all this readily appears when we seek to look into the working possibilities of unfamiliar metals such as the hexagonal metal, beryllium, which would be invaluable if we had enough of it and could make it behave plastically. It is alleged that small amounts of ductile beryllium have been prepared by sublimation, but metal so far commercially available cannot be cold worked. By what process of considering its hypothetical structural faults or the change which might take place in its atoms, or its capability to assume a "ductile" configuration of strain in its crystal structure can we form an opinion concerning its inherent brittleness or ductility.

In short, the purpose of this paper is to give a provisional estimate of prevailing scientific opinion, to emphasize certain divergent attitudes of mind and to point out the need for further study of various obscure features of crystal plasticity.

A careful examination of the early history of investigations concerning the plastic behavior of metal crystals and the discovery of slip-bands was made by Dr. Mathewson. His investigations went back to the work of Ewing and Rosenhain, 43 years ago, on slip markings, and progressed through to the latest work done on strainhardening and recrystallization. The strong and weak points of the various theories were presented. Modern geometrical correlations between extension, change of orientation, shear stress and strain in the operations of slip and twinning were discussed at some length, with analyses of the individual investigations made into these phases by the author. Concepts of slip-interference and an analysis of the Taylor theory of fault propagation lead up to recent work done by Dr. Mathewson and conclusions from his investigations.—**Ed.**

The simple process of utilizing the elastic shear strain energy in the many spacings of a block to strain an intermediate spacing through the potential barrier opposing slip lacks the realization of unbalanced shears competent to force the rearrangement. Thus, in Fig. 1a every spacing of the elastically strained parallelogram (originally rectangular) is held in

and Recrystallization

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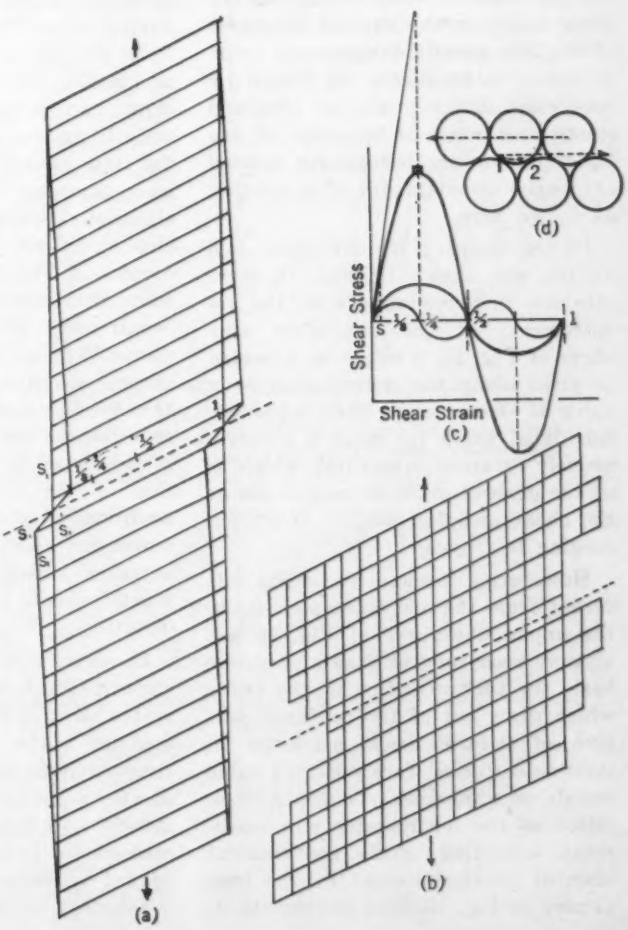
balance by the neighboring spacings. If a slip at the central spacing is carried one quarter of the distance through the identity period (one-eighth on each side of the median plane) the position of maximum shear stress, m, of Fig. 1c (the usual diagram representing shear stress vs. strain in a single spacing), will be reached. There is now the impossible condition of the shear, S_1, somewhat less than the original shear, S, balancing the large shear, designated ⅛, that is, considering the sum of shears on both sides of the median plane, a shear stress somewhat below, n, of Fig. 1c opposed to the maximum shear stress, m.

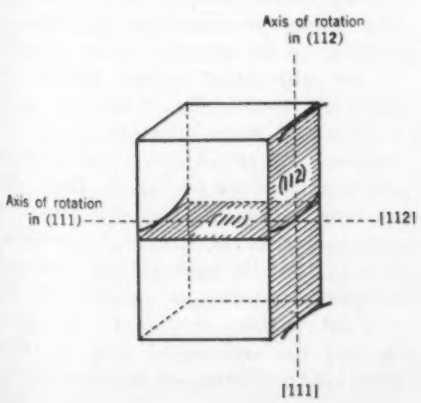
This is not a complete outline of the situation because in addition to the elastic shear strain shown, other components of strain (example, extension) must be encountered and the decreasing shear in the block spacing during the suggested rearrangement may be expected to yield contraction as the atoms approach their normal unstrained positions, while the increasing shear in the central spacing yields expansion as the atoms move over one another. Whether or not this introduces a possibility of realizing any rearrangement of this character, certainly it could not originate in the perfectly homogeneous structure of the original parallelogram. A little reflection however makes it appear highly improbable that all parts of the crystal can carry exactly the same strain, owing to the practical certainty of dimensional irregularities on an atomic scale, as crudely illustrated with great exaggeration in Fig. 1b. Such a structure would yield first at the spacing possessing the smallest number of atoms and the greatest shear strain. Its location in Fig. 1b is at the dotted median line, but in this diagram no attempt has been made to show the assumed small variations in shear strain. There is, therefore, a compelling basis, apart from the assumption of internal faults, for a localized incidence of slip, perhaps continuing through many identity periods, before changing to another site.

In this connection, Treuting and Brick in their examinations of a lightly strained brass crystal, observed shear of the order of 700 atom diameters per active micrographically resolved slip plane and "the evidence is that once this shear has occurred further slip occurs at the next block spacing about 2000 atoms away." Barrett at high magnifications obtained with the electron microscope observed



RIGHT

FIG. 1—Hypothetical elastic origin of slip.



LEFT

FIG. 2 — Diagram of possible fundamental rotations in crystallites.

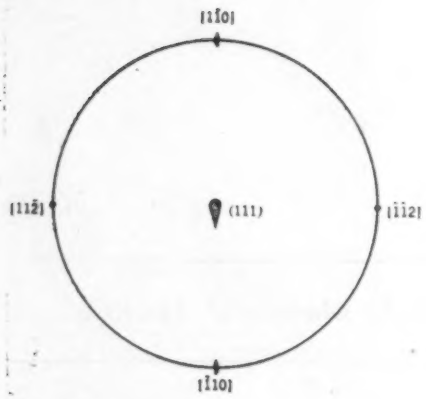


FIG. 3—Schematic pole figure for the (111) plane showing the rotation of crystallites with reference to normal position of slip plane in a strained crystal.

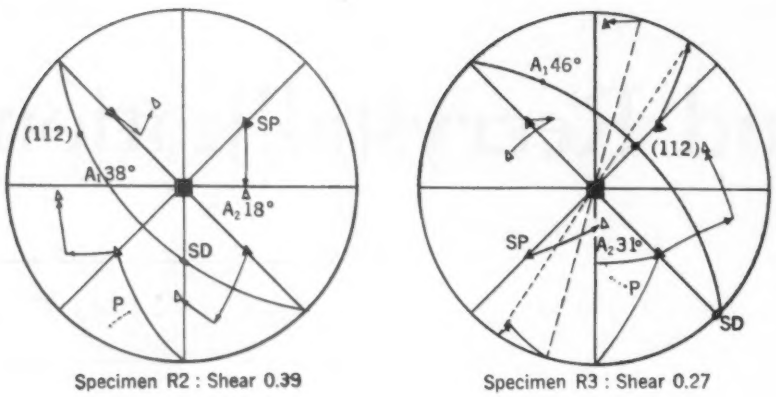


FIG. 4—Stereographic projections with constructions giving orientation of new aluminum crystals (open triangles) from orientations of original strained crystals (black triangles). SP is slip plane; SD is slip direction; P is pole of specimen axis; A_1, first axis of rotation; and A_2 is second axis of rotation.

sharply differentiated lines as if an observed slip had confined itself to one pair of planes.

Fig. 1b cannot be construed to admit a premature incidence of slip at the small shear stress, n, of Fig. 1c constituting a minute fraction, say 1/1000th of the maximum shear stress, m, representing the theoretical potential peak of the barrier opposing slip.*

Parenthetically, it should be noted that in order to make these relationships visible in the various diagrams of Fig. 1 a greatly exaggerated value of n has to be taken. It should lie very close to the origin, as observed elastic shears are of the order of one hundredth or one thousandth instead of nearly one sixteenth of a spacing as shown here.

On the contrary, if a structure such as the one shown in Fig. 1b were strained in accordance with the requirements of the uppermost sine curve of Fig. 1c, it might be expected to yield along the dotted path at a value of stress only a little below the calculated value for m in a homogeneously strained structure; which is of the general order of magnitude or the shear modulus, viz., $\approx G/2\pi$, according to Orowan.

However, a mechanism of slip different from the one corresponding to the upper sine curve of Fig. 1c has already been suggested as a plausible basis for the nucleation of the twins which grow out of the confused pattern of deformational markings in most cold worked face centered cubic metals on annealing. This is a resolution of the macroscopic slip movement, according to the conventional plan of shear indicated by the long arrows in Fig. 1d, into movements, 1, of twinning and, 2, of return to the original structure.

It is assumed that a much lower stress requirement is associated with these movements except at the very early stage of the displacement. In Fig. 1c the hypothetical stress strain curves corresponding to these movements are projected from their true locations 30 deg. clockwise and 30 deg. counter-clockwise, respectively, into the plane containing the previously assumed stress strain relationship during slip. These projected curves lie at the bottom in the left hand half of Fig. 1c. While no detail near the origin can be shown on this scale, the underlying assumption is made that the close packed strings of atoms are load carrying fibers which can be elastically strained in the rational slip directions, denoted by the long arrows of Fig. 1d, through a certain finite displacement before the stress requirement for movement of the atoms 30 deg. out of line of highest stress concentration is realized. From this (yield) point onwards the stress requirement for these new movements is considered to be only a small fraction of the stress requirement for continuation of the original rectilinear movement over the walls of the low-potential valleys, and the result is a plastic shear, or jump, in the new direction.

If, owing to variations of electronic structure, the twin-position is not a stable point of 0-potential, some intermediate curve of shear stress vs. strain may be realized as shown. This is also a projected curve and corresponds to a hypothetical path of decreased resistance denoted by the curved arrow of Fig. 1d.

Inherent in this construction is the necessity for a different kind of rotation from the one accompanying the simple shear of the preceding diagrams (rotation around an axis in the slip plane perpendicular to the slip direction). As shown in Fig. 1d, atom strings pulling against one another in the directions of the long arrows separate laterally while moving forward and this exerts a complication of stress on the spacing which may be expected to yield not only by translation in some direction between the conventional slip and twinning directions but also by rotation around its own polar axis. In other words the weakness of a spacing which is manifest in the commonly recognized process of slip may also manifest itself as a tortional weakness, apart from true shear.

There are two groups of experimental studies that lend support to this theory.

First, the work of Collins, which came under my own observation in the Hammond Laboratory, while directed primarily to the study of rotations in the Taylor sense on a large number of aluminum crystals of different orientations. That is, the spread of diffraction spots from the slip plane corresponding to different settings of the crystal around an axis in the slip plane either normal or parallel to the slip direction, gave evidence of some other form of distortion. The situation is outlined in the simple sketch of Fig. 2. Here, the shading represents the slip direction and the observed change of orientation of the slip plane (111) from its horizontal position is indicated by an arc at either boundary described around the designated axis of rotation [112]. Change of orientation by

rotation of the slip planes around their polar axis is similarly represented by an arc at the upper or lower right around the axis [111], with reference to observations on a vertical surface plane (112), normal to the slip plane. Of course, some condition of fragmentation or crystallite formation by different amounts of rotation in different parts (blocks or lamellal) of the crystal must be envisaged in connection with this sketch.

A general summary of the observed reorientation of the slip plane in the "rotated" or strained crystallites is shown in the form of a schematic pole figure referred to the normal position of the slip plane in the strained crystal, reproduced from Collins' dissertation, Fig. 3. The figure shows poles of the slip plane (111) spread principally in the direction of the [110] pole as would be caused by rotation about an axis [112] in the slip plane normal to the slip direction, together with a small spread of poles in lateral directions* Collins observes that this lateral spread would be caused by rotation about the slip direction [110] or might be of a more complicated nature. Obviously, if the slip direction were changed continuously by rotation of the slip plane about its own axis (II of Fig. 2) the primary rotation about an axis in the slip plane normal to the slip direction would produce a lateral spread of poles, as observed in these experiments.

The major rotation is in the direction of the original unstrained orientation and in addition a small "negative" rotation in the opposite direction (a spread towards [110] in Fig. (3) was observed. The major or "positive" rotation increased with the amount of shear but no relationship between the small "negative" or "lateral" rotation (maximum, 3 deg.) and the amount of shear was apparent.

A direct test of the hypothetical rotation around the vertical axis of Fig. 2 was made by G. H. Found in the Hammond Laboratory utilizing a specially selected single crystal of aluminum made by the strain-anneal technique. The straining process was expected to proceed in simplest form in this crystal because slip plane and direction were equally inclined to the axis (33½-34 deg.). After straining, this angle was found to be 31½ deg, corresponding to an elongation of 7 per cent and a shear of 0.13 by operation of the appropriate slip system. The percentage elongation actually observed in a 2-in. gage length was 10. The X-ray beam was incident to a surface plane, carefully prepared by abrasion and etching, approximately parallel to (112) shown at the right in Fig. 2, and normal to the axis of rotation [111] in the plane. Exposures were made with the angle of incidence of beam to specimen altered in steps of one degree in the vicinity of the normal angle for second order diffraction from the desired (112) plane, using a copper target. Diffraction maxima were found at 66, 67, 68 and 69 deg., indicating a rotation of 4 deg. of (112) planes in the "crystallites" about an axis normal to both the slip plane and slip direction.

Finally, the "Taylor rotation" about an axis in the (111) plane normal to the slip direction was checked in this crystal by examining a surface plane cut parallel to the operative slip plane. Diffraction maxima over an angular spread of 4 deg. were also found in this test.

The other group of experimental results which in my view can be explained only in terms of some form of complex slipping, with an associated complexity of strain, concerns the origin of nuclei in recrystallization after plastic strain and the orientation of the new crystals. There is an abundant literature concerning textural conditions established in the various processes of cold working, which must be carried far along to give recognizable effects of this sort, and in the associated recrystallization structure.

Although certain relationships, including often similarity between the "cold-worked" and "recrystallization" textures have been noted, as if strained elements of the former gave rise to the crystals composing the latter, no good comparison between strained crystallites and recrystallized grains can be made because of the unknown combination of operative slip systems and the incapacity of X-ray techniques to reveal in their definition of the textural pattern the extreme orientations of minute amounts of the "fragmented" crystallites. The earliest studies of recrystallization (for example, Mathewson and Phillips) made it clear that the new crystals grow out of the most severely strained regions of the matrix, as revealed by the etch-markings of severely deformed structures and there have been recent attempts to find the nuclei of recrystallized aluminum in the severe "local distortions" or crystallite rotations around an axis in the slip plane normal to the slip direction, following the analogy of 'guide rollers' operating between the slip planes, associated with the Taylor theory. Barrett reviews this situation with care and finds no clear predominance of the orientations that would be predicted by the Taylor theory in the texture of a single crystal of aluminum compressed about 70 per cent. "While fragments were found distributed throughout a range of 10 deg. from the mean orientation, the spread was not in the directions required by the theory."

In view of the uncertain complexity of the deformation when carried beyond its very early stages, it would seem most fruitful to search for the nuclei of recrystallization in axially strained single crystals oriented wholly within the range of operation of a single slip system. An important observation made by Van Arkel and

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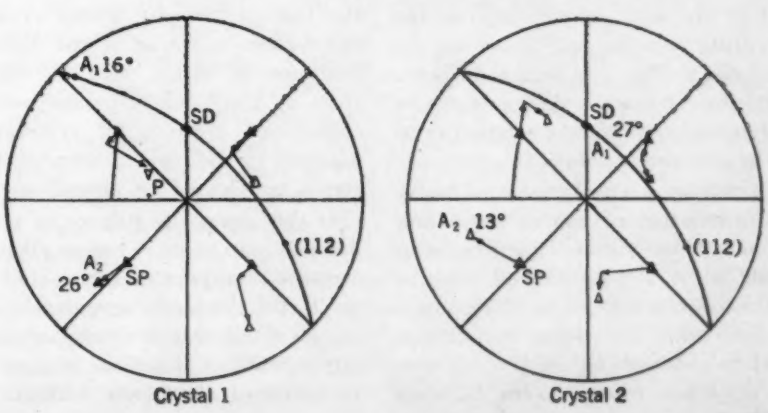
FIG. 5—Stereographic projections with constructions giving orientations of new brass crystals (open triangles) from orientation of original strained crystal (black triangles). SP is slip plane; SD, slip direction; P, specimen axis; A_1, first axis of rotation; and A_2 is second axis of rotation. Percentage elongation of strained crystal, 3.75; shear is 0.074.



Van Amstel that the growth of a crystal into its surroundings ceases if it is given even a slight amount of plastic strain seems to demonstrate that nuclei originating (by common observation) in the most severely strained parts of a crystal must have lost their strain before they started to grow. This has been interpreted in various ways. It may be imagined that they form spontaneously in the strained structure much as crystallization nuclei form in liquids. I prefer the interpretation that they are fragments or crystallites in a finite condition of strain which at the effective temperature of recrystallization are unloaded from within and begin a new existence in their reoriented state as strain-free, growing crystals.

It is not difficult to visualize fragmented areas of slip planes held in various stages of elastic shear strain between the macroscopic blocks with which we associate the term, block slip. While no complete picture of an internal unloading mechanism can be given, we know that the strain disappears on annealing and it may be presumed that these strained crystallites tend to rotate as a simple mechanical model of elastically sheared blocks would on removing the tension load. If, in the simplest atomic model, the elastic shear had been less than halfway through an identity period the rotation would be towards the original unstrained configuration and if it had been more than halfway, so as to reverse the shearing force the rotation would be away from the initial orientation.

A wide angular spread of orientations might result from such a process but the slip plane of reference in these nuclei would lie wholly in a zone determined by [112] the axis of rotation in the case of [110] slip in the generally accepted sense.

Collins and Mathewson have shown the orientations of two aluminum crystals obtained by annealing single crystal tension test pieces, designated R2 and R3, after straining to shears of 0.39 and 0.27, respectively, on the operating slip system. These are reproduced in Fig. 4. In neither instance could the orientation of the new grains be related to that of the original crystal by any single rotation.

Obviously, a simple way to derive the orientation of one of these new crystals from that of its progenitor would be to find an axis of rotation in the original slip plane which would transfer this slip plane to its new location and then adjust the positions of all other rotated poles to their observed final positions by a second rotation, this time around the pole of the reloçated slip plane. These operations are indicated by the arrows of Fig. 4.

A similar treatment of the two recrystallized grains obtained by Treuting (Yale Dissertation 1942) from a single crystal of alpha brass annealed 15 hr. at 1562 deg. F. after straining in tension to an average shear over

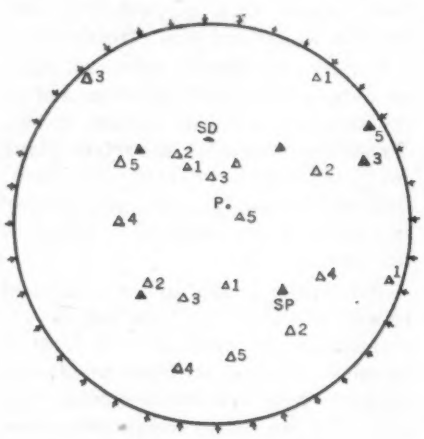


FIG. 6—Stereographic projection of the orientation of a deformed brass single crystal and of the five new grains formed upon recrystallization. Solid triangles are poles of original strained crystal (after shear of 0.25); open markings are poles of new crystals; P is the pole of the stress axis; SD and SP the original slip direction and plane.

a 5-in. gage length of 0.074 is given in Fig. 5.

In spite of the generality of this process, which obviously can produce any desired reorientation, a physical basis is apparent in the assumption previously discussed that slip between blocks, actuated by elastic strain in the conventional [110] slip direction throughout the block spacings, can pursue a curved path of minimum resistance, resulting in complex strain, chiefly characterized by rotation around a variable axis in the slip plane combined with rotation around the pole of the slip plane. Various orientations arise from the different positions of strain held in equilibrium by the block structure and the consequent diversity of orientations assumed by the crystallites when their strain is released on annealing.

If this composite picture of plastic deformation and recrystallization seems extravagant in its non-conformity to the generally accepted idea of simple translation in crystallagraphically significant directions, it must also be admitted that some hitherto unannounced complexity of deformation is needed to clarify the devious relationship between recrystallized grains and the strained crystals from which they originate. In this latter connection, Barrett (l.c. p. 73 of this section) has given many examples of unpredictable orientations in the recrystallization of aluminum after extensive compression and I have reproduced in Fig. 6, from R. G. Treuting's dissertation, a projection combining the orientations of five recrystallized grains with the orientation of the original crystal after the comparatively small amount of strain which produced a tensile elongation of less than 10 per cent. The octahedral poles shown do not exhibit any easily specified characteristics of orientation. Perhaps the near-randomness of this distribution is influenced by the condition that the axis of the crystal had reached a position corresponding to double slipping (which was actually observed on the specimen) and is so near the center of the projection that stress inhomogenities might easily bring additional, closely adjacent, systems into play.

Crystal No. 5 can be traced to twinning on the second slip plane, whose pole is the filled triangle in the upper left-hand quadrant, by performing the simple rotations corresponding to the assumed condition of strain in its original nucleus, such as a rotation of about 10 deg. around an axis in the slip plane bringing this pole to the nearby position numbered, 5; followed by the usual twin-rotations (180 deg. around the pole of the twinning plane) of the other octahedral poles, after their rotation around the first axis, and finally a rotation of some 20 deg. of these three 'twinned' poles around the first. This brings all poles numbered, 5, into the positions shown.

Crystal No. 3 is also twinned, but in this case with reference to the filled triangle in the lower left hand quadrant which would not normally operate as a slip plane in stretching a single crystal with its axis in the designated position, P. The condition of double-slipping is not well enough understood in relation to the present interpretation of slip in its simplest form to permit any evaluation of this abnormality, which may indeed be due to some unknown conditon in the crystal or unsymmetrical application of stress. Crystals 1, 2 and 4 may obviously be derived from the original crystal by the double rotations previously described.

Basic Welding Research

Greatly Extends Range of Knowledge

MANY technical papers presented at the 24th annual meeting of the American Welding Society relate to basic studies on the hardenability of steel in the heat affected zone of fusion welded structures. Approaches being made from a half dozen directions by college and industrial research groups are in surprisingly close agreement and it is now possible to predict the ductility of a welded joint resulting from a given welding procedure. Other papers dealt with more practical problems in welding in aircraft, shipbuilding, railroads and powerplants. A number of the more significant reports are abstracted here.

Weldability as Related to Ductility of Heat Zone

LARGELY as a result of some important failures in ships during the past year, some basic studies are now being undertaken relating to the physical and metallurgical phenomena that occur in arc welding. An important series of papers on this subject opened the meeting of the American Welding Society on Monday afternoon, all of them discussing weldability of steel as related to the ductility of the metal in the heat affected zone. Two separate approaches have been made on the problem, one by a group at Lehigh University and the other at Rensselaer Polytechnic Institute and it is remarkable how closely these two reports agree in the final analysis although the approaches were widely different.

Gilbert E. Doan and Robert D. Stout of Lehigh University presented a tentative system for controlling ductility in weldments by relating the ductility to the Vickers hardness number in the heat affected zone. The hardening response of any given type of steel is measured by the Jominy test and the ductility is determined by bend tests made on treated specimens. In the Lehigh system, the 1 in. Jominy test bar is heated to 2100 deg. F. instead of 1700 deg. as is normally the practice in order to more nearly obtain a grain size usually found in the heat affected zone, which is heated well above the critical. Based on the heat input into the weld as governed by the power (volts x amperes converted into joules) and the speed of welding in linear inches per minute, it is possible from the data accumulated to predict what the hardness will be in the heat affected zone of some new steel and by making a Jominy test on this steel the quenching effect of the surrounding metal is estimated. In the Lehigh system, the cooling rate in the heated zone of the weld is assumed to be a function of the heat input divided by the cross-section of the metal within a 3 in. radius of the weld. The welding energies required for different steels are determined by means of cooling rate-distance relationships on the Jominy bar combined with energy-distance relationship established for the base steel investigated. For example, it was found that with 175 amp. current at 26 volts and a welding speed of 6 in. per min., the maximum hardness obtained corresponds to a point 0.34 in. from the quenched end of a Jominy bar.

The program of the Rensselaer Polytechnic Institute undertook the measurements of actual cooling curves in the heat affected zone immediately adjacent to the weld metal. The experimental data were used to modify fundamental mathematical solutions which could then be used graphically to greatly extend the coverage of the data. With these data, together with an inspection of an s-curve of the type of steel whose welding conditions were desired, plus a specially prepared Jominy bar from the same heat as the steel to be welded, it became possible to predict welding conditions to give any desired metallurgical structure. In order to determine the resultant ductility it is either necessary to test a sample weld using the welding conditions selected to give a particular structure or the same hardness-ductility relationship involving notch bend tests already established at Lehigh can be employed.

The Rensselaer group has worked out elaborate mathematical formulae which take into account the initial temperature of the plate, plate thickness, the effective heat input in watts, the speed of the electrode travel and the physical properties of the steel including thermal conductivity, density and specific heat. To check these formulae, actual temperature measurements were made with thermocouples and a rather close check was found between the measured cooling rates and the calculated rates. In the published report of the paper, 64 tables of data are given, showing the energy input in joules per inch required to produce any desired cooling rate at any initial temperature, ranging from 37 to 400 deg. From joules per inch, obtained from the table, arc current may be calculated by multiplying this figure by travel speed in inches per minute and dividing by the arc voltage times 60. These tables provide the desired link between cooling rates in the steel plate and welding conditions.

Cascade System

One of the fundamental principles for the avoidance of cracking of welds in hardenable steel is to temper the structure before the temperature has dropped much below the martensite-forming range. If a cascade technique is arranged so that a second pass is deposited before the temperature in the zone adjacent to the first pass drops below a certain temperature, the heat of the succeeding pass can temper the preceding pass and help to prevent cracking. In order to determine the time available between passes for such cases, another special mathematical solution has been developed by the Rensselaer group.

It has been found experimentally that cooling rates determined on ship

steel, ASTM A131-39, will be reproduced in SAE 1035, NAX9115 and NE 8620. From this it may be concluded that such differences in thermal properties as do exist between these steels have a minor effect on the cooling curve produced by the same energy input. The only factors which need to be considered as affecting weld cooling rate in a wide variety of plain carbon and low alloy steels are energy input in joules per inch, plate thickness, plate temperature and joint geometry, that is whether the joint is a simple butt, fillet weld, etc. The electrode size used with a given energy input has an effect on cooling rates, the larger electrodes producing lower cooling rates. This appears to be due to the difference in the amount of metal deposited. Incidentally, the cooling rate data obtained in this investigation have been found to be equally applicable to a.c. and d.c. welding.

A guide book covering in detail these two methods of approach is now being published serially in the Welding Journal of the AWS and will eventually be published in book form.

Cooling Rate by Electrical Analogy

Tying directly in with the work done at Rensselaer and Lehigh is a research project carried out in the heat transfer laboratory at Columbia University with the purpose of throwing some light on the mechanism of heat flow during the cooling period in arc welding of plate. The investigation has been carried out by the method of electrical analogy, using a heat and mass flow analyzer developed at Columbia. The method used in the present case was to study the mechanism of heat transfer from the arc to the plate. Welding conditions taken into account include energy input, rate of input, welding speed and preheat temperatures. The great variety of conditions tends to make it very difficult to obtain general solutions which can be readily understood, but Victor Paschkis of Columbia who presented the paper, was able to give two general charts, one for each of the two components of energy transferred to the plate; namely, by radiation and by the heat contained in the metal melting off the electrodes. It was found that the cooling curves established at Columbia checked closely with the cooling curves found at Rensselaer by direct thermal measurement. The author concluded that more correlation with direct thermal measurements is required before these curves can be put to practical application under present conditions and that much more test data would have to be accumulated with the electrical analyzer.

Adams Lecture

The meeting of the American Welding Society proper was opened by a lecture by Dr. Comfort A. Adams, professor emeritus at Harvard University who pointed out some of the fundamental principles of transfer of energy from electrical to heat form and the solution of problems involving temperature gradient in arc welded structures. The speaker delivered the first of the Adams Lecture, recently set up by the A.W.S. in order to honor its founder and first president, Dr. Adams. Dr. Adams has been a professor at Harvard University since 1891 and during these years has acted as a consultant for many industrial concerns. Since 1932 he has been consulting engineer for the Edward G. Budd Mfg. Co. The formation of the American Welding Society grew directly out of the work of the welding committee of the Emergency Fleet Corp. which was then under the chairmanship of Dr. Adams. Besides being president of the A.W.S., Dr. Adams also has been president of the American Institute of Electrical Engineers in 1918-19.

Weld-Bead Hardness Tests

Tests made on weld-bead hardness on some carbon, nickel and nickel-chrominum War Department steels were reported by Oscar E. Harder and C. B. Voldrich, Battelle Memorial Institute, following the procedure tentatively set up by the A.W.S. in April 1942. The steels tested included 22 plain carbon steels, three nickel steels, and nine chromium-nickel steels. All were tested at original plate temperatures of 65 deg. F.

The lowest hardness at which a crack was found was 566 Vickers. Of the six steels which cracked with plate temperatures of 65 deg., only one (WD 3250) cracked when the plate temperature was raised to 300 deg. For WD 1340 steel, raising the initial plate temperature from 65 to 300 deg. decreased the Vickers hardness from 566 to 421. On the other hand increasing the plate temperature of WD 3250 steel did not change the maximum hardness. Decreasing the plate temperature from 65 deg. to –20 deg. F. had only a slight effect in increasing the maximum hardness, and in some cases lower hardness values were obtained.

For most of the steels there was found to be a generally consistent relation between the maximum hardness obtainable in the bead and the carbon equivalent $(C+\frac{Mn}{6})$, that is, the hardness rose as the equivalent carbon rose. Some of the steels of higher carbon equivalent, however, had a marked departure from this general relation according to the authors and they suggested the amount and character of martensite formed is an important factor. The alloy steels with nickel or with nickel and chromium gave substantially higher hardness values for a given carbon equivalent than the plain carbon steels, with the SAE 2300 steels giving higher values than the SAE 3100 steels. No attempt was made by the authors to calculate the equivalents of such elements as nickel and chromium.

Weldability of Silicon—Manganese Steels

An investigation on the effect of silicon content with varying carbon and manganese on mechanical properties and weldability of a variety of steels indicates that silicon is to be preferred to carbon or manganese for the production of high strength normalized steels for welding, according to C. E. Jackson, G. G. Luther and K. E. Fritz, Naval Research Laboratory. The silicon steels showed lower weld hardening and higher weld ductility. The authors pointed out that weld hardening results are dependent upon the carbon content and hardenability of a steel and both must be considered in analyzing the effect of a welding technique on hardness. The authors used the weld-bead hardness tests and compared the results with Jominy tests on bars of steel of the same analysis.

Spot Welding Techniques

Tests made on the spot weld joint efficiency for aluminum alloys, made at the research laboratories of Curtiss-Wright Corp. and reported by C. W. Stewart, indicated that maximum joint efficiencies of 100 per cent can be obtained, with average strength of 93 per cent of the parent metal. Experiments showed that the ideal spot pattern for 24ST Alclad of 0.040 in. thickness is one in which the spots are spaced ½ in. apart in both directions. Reduction in this spot spacing is likely to result in a loss of strength of the joint, Mr. Stewart stated. Maximum stress developed on a standard test specimen was 61,800 lb. per sq. in. and the

average was 59,800 lb. Incidentally, it was found that in tensile testing, three spots of normal strength, parallel to the load, would be sufficient to insure failure by sheet tension when the spacing was ½ in. and the spot shear strength was 500 lb. or better.

Tests were made on welds made both with an a.c. machine and a stored energy capacitor type d.c. machine. It was found that higher strength welds can be made with the a.c. equipment than with the d.c. equipment and that the former type welds are free from microscopic cracks. However, the presence of these cracks, visible by radiograph inspection only, is not critical. In all tests, the faying surfaces were cleaned by wire brushing as it was found to be superior to chemical treatment. In both types of apparatus, the electrode force was 1200 lb. and the tip radius, 3 in. No forging pressure was used with the capacitor type machine.

Speaking of spot welding of aluminum alloys in production, N. C. Clark, senior research engineer, Lockheed Aircraft Corp., emphasized that statistical control is essential for the maintenance of high consistency and adequate strength of spot welds and as a means of fairly measuring the quality of production. Statistical control, based on the sampling of production and subsequent analysis and prediction of quality, Mr. Clark said, can be used to advantage in a number of ways—measuring the quality of the product, predicting trouble before it occurs, assuring optimum machine performance and developing the most economical specifications for the spot welding process. Mr. Clark also urged monitoring of the spot welding machines or non-destructive testing of the finished product. Standardization of the equipment and the process is always the first step in any quality control program and these other controls are largely used to maintain standard conditions. With spot welding machines of the stored energy type, the operating factors most in need of standardization are the control of energy delivered to the weld, electrode current wave shape, the amount of electrode force, forge time delay (if used) and the shape, surface condition and life of the electrode tips.

Spot Welding Magnesium

Both alternating current and stored energy type welders have proved satisfactory for the spot welding of magnesium alloys, according to a report prepared by the Magnesium Welding Subcommittee of the Aircraft Welding Research Committee of the Engineering Foundation, summarized by W. S. Loose, chairman of the subcommittee. The technique for spot welding magnesium alloys is very similar to that employed for aluminum alloys. The variables that affect shear strength and consistency of aluminum alloy spot welds similarly affect spot welds in magnesium alloys and the cures for defects are normally like those employed with aluminum alloys. The essential requirements of the equipment for spot welding magnesium are reasonably high welding current capacity, positive control of pressure and accurate control of welding time. Machine settings are substantially the same as required for aluminum.

Flashing of weld metal, surface heating and pickup, cracking or porosity may be eliminated by increasing the welding pressure, decreasing the welding current, increasing the pressure and current simultaneously, or by increasing the radius of the electrode and increasing both the pressure and current. In some cases, a more thorough cleaning of the sheet surface may be necessary. Magnesium alloys are normally prepared for spot welding by wire brushing or use of steel wool. No commercial process for chemically cleaning such alloys prior to spot welding has yet been developed.

Table I gives data on typical machine settings for welding equal gages of three different types of magnesium alloys, as performed on electromagnetic stored energy equipment. In general electromagnetic stored energy machines operate the same on magnesium alloys as do the electrostatic type. Figs. 1 and 2 give approximate capacitance and voltage settings for two different types of magnesium alloys. Since the transformer-turns ratio not only varies the current peak during welding on condenser-discharge machines but also varies the time of discharge, it has been found that a high-turns ratio is best although it results in a somewhat longer welding time (0.05 to 0.13 sec.). Short welding times tend toward flashing and resultant cracked welds.

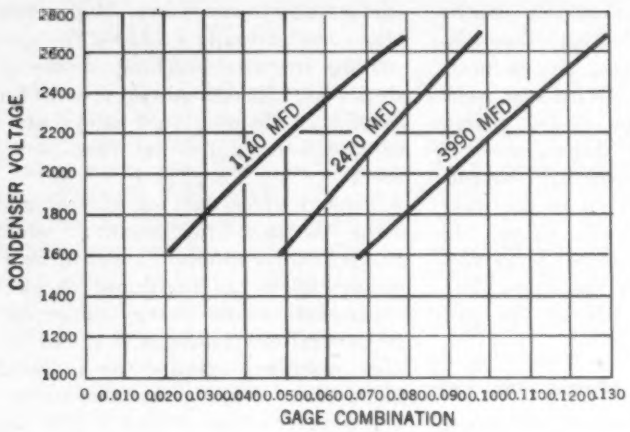
Magnesium Spot Welding Electrodes

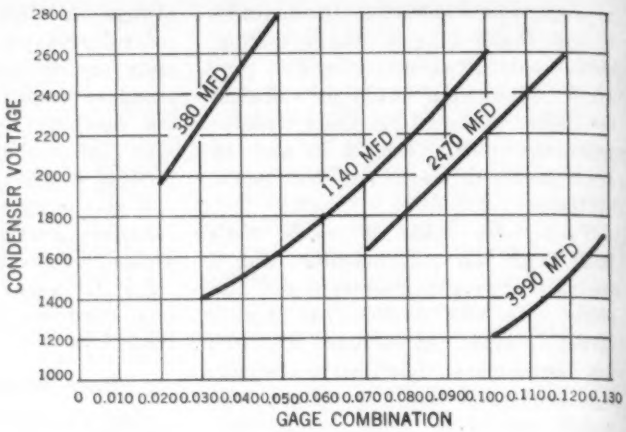
Electrodes for magnesium spot welding are made from hard, high conductivity copper alloys meeting R.W.M.A. Class I specification. These electrodes must be water cooled, preferably to within ⅜ in. of the welding face. Tip contours of ⅛ to 7/16 in. by 4 deg. flat, or 2 to 8 in. dome radius are most satisfactory. Electrode cooling is an important factor in pick-up although cooling to excessively low temperatures has a harmful effect since condensation takes place, materially increasing the resistance between electrode and sheet during welding and resulting in more rapid burning or pickup. About 100 to 150 spots may be made between tip cleanings when welding the 6A1-

TABLE I

Welding Settings on Electromagnetic Machines

Sheet Thickness, In.	Precompression, Lb.	Weld Pressure, Lb.	Forge Pressure, Lb.	Heat	Primary Current, Amp.	Delay Before Charging, Cycles	Time of Recompression, Cycles	Tip Radius, In.
				Mg +1.5Mn				
0.040	400	400	1200	With	175	10	30	4
0.064	580	580	1740	Without	300	10	30	4
0.125	1900	1080	4750	With	725	20	30	4
				Mg + 6Al + 1Zn				
0.040	500	500	500	Without	160	10	30	4
0.064	480	480	480	Without	215	10	30	4
0.125	3216	3216	3216	With	725	20	30	4
				Mg + 3Al + 1Zn				
0.064	560	560	1680	Without	200	10	30	4





UPPER LEFT

FIG 1—Approximate voltage and capacitance settings for condenser discharge welding machines using recommended pressures and tip contours on 1.50 Mn magnesium alloy annealed sheet.

ABOVE

FIG. 2—Approximate voltage and capacitance settings for condenser discharge machines using recommended pressures and tip contours on 6.00 Al, 1.00 Zn magnesium alloy hard rolled sheet.

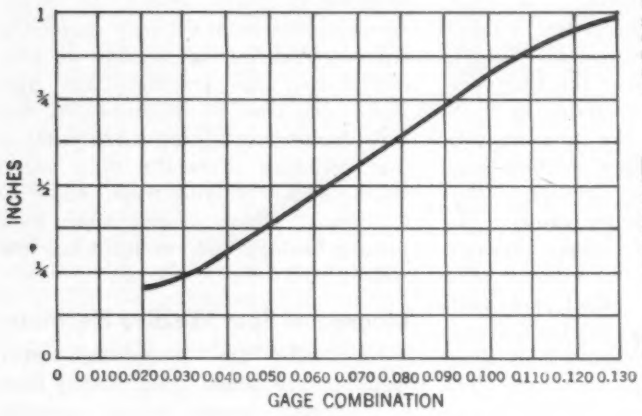


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FIG. 3 — Recommended minimum spot spacing for spot welded magnesium alloys containing 1.50 Mn, and 6.00 Al—1.00 Zn.

1Zn alloy sheet whereas on the 1.5 Mn alloy, electrodes must be cleaned every 10 to 20 spots. Burned areas must be carefully removed from spot welds, for copper pickup may cause electrolytic corrosion. Recommended minimum spot spacing for spot welding these two magnesium alloys is given in Fig. 3.

Weldability of Aircraft Steels

An immense amount of data covering the spot weldability of various types of aircraft steels were presented by Leon C. Bibber and Julius Heuschkel of the Carnegie-Illinois Steel Corp. Seven different methods of test were used on over 4000 specimens: Twist, tension-shear, tension-pullout (U. S. Army Air Force), tension-pullout (Bur. of Aero., U. S. Navy), looped tension-shear impact, special spot-welded continuous tension and special seam-welded continuous tension.

In general it was found that the spot weldability of the USS Air-Ten steels is good for all grades, varying in yield strength from 25,000 to 100,000 lb. per sq. in. The spot weldability of the 18-8 chromium-nickel steels is excellent for all tempers ranging in ultimate strength from 75,000 to 185,000 lb. per sq. in. The SAE 4608, SAE 4017 and the modified NE 8620 steels are in certain spot welding characteristics inferior to the above materials, but they are in general fairly weldable by single-impulse spot welding. On the other hand, the single-impulse spot weldability of SAE X-4130 is open to considerable question and the authors urge great caution in applying this material where single-impulse welding equipment only is available.

Stored Energy Steel Welding

Stored energy welding is excellent for light gages of mild steel, according to tests made by Yellow Truck & Coach Mfg. Co. with a capacitor type machine. J. M. Diebold, presenting a paper on this subject, said that the quick shot localizes the heat so that with proper electrode care, strength and uniformity will be very good and metal finishing costs reduced since there is no electrode indentation if the proper controls are used. Although work done on this equipment is not as fast on standard a.c. equipment, the higher quality of the work makes this process competitive, according to Mr. Diebold.

With proper settings and fairly clean steel, wiped free of grit and excess oil, welding results are not only consistent, but flashing and spitting are rare, making more pleasant machine operation for both operators and supervisors. In fact, the author concluded that most present day welding equipment is ahead of mild steel specifications now in use in that the welding unit is capable of delivering more consistent results than are obtainable from various heats of SAE 1010 steel. Future developments in mild steel welding metallurgy seem indicated before manufactured quality can advance much further.

Voltage Zones and Bead Growth

The tests conducted at Yellow Coach indicated that there are four definite zones of condenser voltage which have a definite relationship to the nugget or bead growth and hence bead strength. As shown in Fig. 4, Zone 1 represents the range of voltages where the bead grows very fast and the strength rises rapidly in proportion to voltage increase. The upper limit of this phase was found to be that point at which the first slug is pulled or where the bead has reached sufficient size to be stronger across its diameter than the parent metal is around its perimeter. Zone 2 finds the slug size growing with the bead, but strength rises more slowly with increasing voltage, since the area of the bead increases as the square of the radius while the perimeter of the bead increases in direct proportion with the radius. The upper boundary of this zone is reached when the bead becomes full size, that is, the diameter of the electrode faces.

In Zone 3 the curve is almost flat and is considered the proper range for best welding results. During this range of voltage increases, the bead diameter growth is negligible and its increase in size takes place in its depth. The end of this phase occurs when the bead grows to a few thousandths of an inch from the surface

under the electrode and the bead diameter again begins to grow. Slug size remains constant and hence strength fails to rise appreciably, but the physical characteristics noted during this phase are most desirable and weld strengths were found very stable. Expulsions and extrusions were rare and flashing and spitting were only occasional.

In Zone 4, on the other hand, various faults begin to appear that are so often found in production welding; flashing increases sharply and extrusions and expulsion occur in every weld. The weld takes on the appearance of a large black spot and the indentation becomes very heavy, with surface pitting and burring. Porosity is noted, although the strength is higher but is very inconsistent and ductility is considerably reduced. Incidentally, in other tests it was observed that various pressure settings gave almost the same strength values so that the final control of the weld is in the voltage of the capacitor, which obviously would vary with the gage of sheet used.

Spot Welding Hardenable Steel

Continuing in the work started two years ago on the post heat treatment of spot welds in the machine by a second current flow through the weld, Dr. W. F. Hess and D. C. Herrschaft of the welding laboratory at Rensselaer Polytechnic Institute reported at this meeting an investigation which showed that remarkable increases in physical properties are possible for SAE 1020, 1035 and 1045 steels by proper control of the weld cycle time interval between welding and heat treating and the length of the heat-treating cycle. The results are summarized in Table II which shows the recommended condition for spot welding these three steels of 0.040 in. thickness.

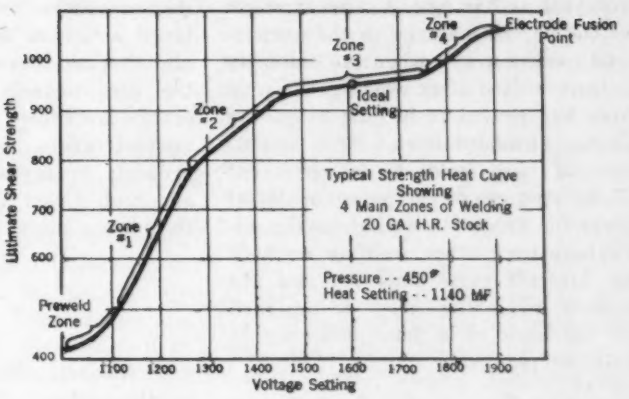

FIG. 4—Typical curve showing the four characteristic zones found in complete welding range for mild steel spot welded on a stored energy type machine. Ideal setting shown.

The remarkable increases in physical properties are summarized in Table III where it will be noted that for SAE 1020 the shear strength may be increased by 10 per cent and U-strength tripled by tempering. For SAE 1035 steel the shear strength is increased by 70 per cent and the U-strength nearly tripled by tempering, while in the SAE 1045 steel the shear strength may be nearly tripled and the U-strength increased nearly 10 times by tempering. A significant improvement in the toughness of spot welds is also obtainable when the carbon content is as low as 0.20 per cent. Very much greater improvement in toughness results in welds of higher carbon content, since under single-impulse welding they are ordinarily very brittle. This investigation showed that steels with carbon content as high as 0.48 per cent could be successfully spot welded when the tempering cycle is included. Significant improvement in the shear impact strength of spot welds is also possible with the temper treatment, the ratio of the improvement varying from about two to more than eight, as the carbon content increases from 0.20 to 0.48 per cent.

Flash Welding in Aircraft

Flash welding is being quite extensively used in airplane construction, according to C. B. Smith, Douglas Aircraft Co., Inc. The part most frequently made by flash welding is the engine control rod made from a tube either ⅜ or ½ in. in diameter with a wall thickness of approximately 0.035 in., on which are flash welded suitable end fittings turned out on the screw machine. Parts of this type can be flash welded on both ends in less than a minute so that the total cost is nominal. Also a very satisfactory engine mount is being made in which threaded forged ends are flash welded onto tubing to form the struts which in turn are bolted to forgings to complete the mount assembly. A similar method of construction is used in the landing gear, where special machined forgings are welded on tubing and later bolted into the assembly. In hydraulic equipment, pistons are flash welded to piston rods and heads are flash welded on cylinder assemblies.

As a result of a large number of tests, unheat-treated flash welds are

TABLE II

Recommended Conditions for Spot Welding SAE 1020, 1035 and 1045 Steel of 0.040-In. Thickness

	SAE 1020	SAE 1035	SAE 1045
Flat electrode diam., in.	¼	¼	¼
Electrode shape	30° bevel	30° bevel	30° bevel
Unit electrode pressure, lb. per sq. in.	30,000	30,000	30,000
Corresponding total electrode force, lb.	1473	1473	1473
Weld time, cycles	6	6	6
Weld current, amp.	15,800–16,200	14,000–14,400	13,600–14,000
Time between weld and heat treatment, cycles	17	20	24
Time of heat treatment, cycles	6	6	6
Heat-treatment current, amp.	14,100–14,700	12,600–13,200	11,900–12,400
Heat-treat current, % of weld current	88–92	89–93	86–90
Distortion ratio	1.04–1.06	1.03–1.05	1.10–1.13
Per cent indentation	5.0–7.0	2.5–3.0	1.0–1.5
Spot diam., in.	0.220–0.240	0.210–0.230	0.200–0.220
Type failure	Ductile tear	Ductile tear	Ductile tear

accepted as having the same strength as the parent material in the normalized condition and when the assembly is heat treated after welding, the weld area has proved to be just as strong as the unwelded area. This acceptance of flash welds at 100 per cent of the strength of the parent material gives the process a weight saving advantage over other welding methods for aircraft parts since arc and gas welded assemblies must be designed on the basis of a joint efficiency of only 80 per cent.

Test Coupons for Control

Control over the flash welding process is maintained through the use of test coupons made from scrap parts. Exhaustive tests are made for each new type of joint so the machine setting finally used is backed up with ample test data and the settings can be recorded for future use. In addition to control tests, all production parts are proof loaded wherever possible, usually in tension. The magnitude of the load is the maximum which can be applied without damage to the part if the flash welds are sound. In normal production from 1/10 to 1/2 per cent of the parts welded are found to be defective in proof loading, according to Douglas experience.

Flash Welding Nickel Rods

Tests made at Rensselaer Polytechnic Institute on the flash welding of ¼ and ⅜ in. diameter nickel, Monel, "K" Monel and Inconel rod indicate that three major defects may be found in these materials as a result of improper machine setting, according to a report presented by Dr. W. F. Hess and Albert Muller. These defects consist of line oxide at the weld interface, trapped dendritic material at the weld interface, and partial melting of the grain boundaries in the weld region. When high resistivity materials of compact cross-section are welded in machines providing current conduction to the work from only one side of the clamping device, cracks result from the combined action of high current density and thermal stresses at the edges of the dies nearest the weld. These cracks are known as "die burns." The microstructure and properties of properly made flash welds in nickel and high nickel alloys are similar to the parent materials.

In making the proper machine settings, the more important welding variables to be taken into account are cam shape, flashing distance, flashing time, amount of upset, time of current flow during upset, available short-circuit power level and material preparation prior to welding, the authors stated.

Welding in Shipbuilding

Of the half dozen papers presented on the subject of welding in shipbuilding, the one that drew the greatest attention was the report of the thermal stress subcommittee of the A.W.S. marine committee on cracking in ship construction, read by H. W. Pierce, chairman of the subcommittee, and welding engineer of New York Shipbuilding Corp. Reviewing the history of specifications for large welded structures like ships, Mr. Pierce indicated that 10 years ago specifications on welding were so highly restricted that they became a serious bottleneck to production. Later as coated rods replaced bare electrodes, there was a tendency to open up these specifications and the pendulum swung too far in the other direction, with the result that certain notable failures occurred. Now the pendulum is swinging back to a much closer specification on welding technique in shipbuilding.

The first report of the thermal stress committee was made in September 1941 and Mr. Pierce began by restating the conclusions reached in this report which were that failures occur under the following conditions:

1. The residual stresses become dangerous only when the carbon content is high enough to produce brittleness and to prevent plastic flow from taking place.

2. Where the design produces a notch sensitive state of the materials, or where the materials themselves have a low impact value.

3. Where the plates are so thick and the structure so rigid that plastic flow cannot occur.

4. Wherever localized areas of three dimensional stress are built up.

5. Where the stresses are of an alternating nature and where stress raisers are present, there is always the possibility of fatigue failure.

An examination of recent failures, said Mr. Pierce, reveals a bewildering number of reasons for failure, always in combination and in a wide variety of locations. Once started, cracks rapidly propagate themselves and follow a general pattern. The observation of brittle fractures, without necking down and occurring at right angles to the plane of the plating, indicate the presence of three-dimensional stresses which prevent plastic deformation along definite slip planes. In such failures there is a notable absence of typical shear fractures which present a "silky" appearance.

While residual stresses share the major blame for failures, among the contributing factors inferior workmanship is the prime cause. This can only be overcome by eternal vigilance on the part of supervision and good operator training. Following in order of causes are poor materials, poor design and as a corollary thereto, high stress concentration. Preparation of the parts prior to welding is also important. Mr. Pierce indicated that much has yet to be learned about residual stresses and that the problem is terrifically complicated. Many investigations now underway as indicated by the large number of papers

TABLE III

Summary of Test Results for Spot Welding SAE 1020, 1035 and 1045 Steel 0.040-In. Thickness

	As Welded			Heat Treated		
Grade	Shear Strength per Spot, Lb.	U-Strength per Spot, Lb.	Impact per Spot, Ft.-Lb.	Shear Strength per Spot, Lb.	U-Strength per Spot, Lb.	Impact per Spot, Ft.-Lb.
SAE 1020	1500–1600	350–370	6.5–8.0	1650–1750	1100–1200	14.5–16.0
SAE 1035	1200–1260	210–250	3.5–5.5	1900–2000	600–700	21.0–22.0
SAE 1045	870–890	80–120	1.5–2.0	2450–2550	800–900	11.5–13.5

presented on the weldability of steel and the measurement of cooling rate and plate hardness associated with arc welding.

The most serious cause of locked-up stresses occurs when closing welds are made on big assemblies that are not free to move. The shrinkage which takes place across the weld sets up enormous stresses. Another factor is residual stresses left by thermal differences within the plate. The speaker pointed out, for example, that most investigations add up to the fact that major stresses are obtained near weld regardless of the procedure. He reminded his audience that heavy rolled shapes often have a terrific amount of residual stress in them, right up to the ultimate strength.

The obvious way of reducing residual stresses is to stress relieve in a furnace at 1200 deg. F. and cool slowly. Of course, this procedure is not applicable to ship hulls, although it may be used on stern posts. Preheating reduces the residual stresses since the heat differentials are reduced but improper preheating can also generate large stresses on its own account and is therefore not to be highly recommended, said Mr. Pierce.

Mechanical peening is the most widely used tool for stress relieving. Almost any type of peening tends to reduce peak values, though the final stress is indeterminate. The advantages are such as to outweigh any increase in cost due to the added operations. The overall cost in the long run is lower.

Operating Sequences

Operating sequences in welding procedure are now being widely investigated, but Mr. Pierce indicated that some sort of engineering control is essential. There is a bewildering number of technical factors involved in welding and the procedures are very complicated and hard for the average working force to follow. This means a great deal of attention must be given to education not only of the welders but of the leadermen, foremen and other supervisors. In order to avoid the reaction stresses mentioned previously, the committee recommends the completion first of joints that provide some freedom of movement and in making the final closing butts, the use of small electrodes and low heat in order to keep down the contraction effect. Cascade, skip and similar welding procedures are also valuable, provided they are followed by peening. Tack welds should be made light enough so that they will break where the stresses run high. These can later be chipped out and rewelded. Notch effects in conjunction with high reaction stresses makes failures almost inevitable.

Many difficulties result from welding in cold weather. The temperature gradient is higher and the notch sensitivity of the plate itself increases. Izod and Charpy impact values are one-quarter those prevailing at summer temperatures. There is also the other angle of poor workmanship in bad weather that generally occurs due to discomfort of the worker. Mr. Pierce warned, however, that ships made in southern waters may fail in cold water before the locked-in stresses can be worked out by mechanical weaving of the ship.

In commenting on this report, David Arnott, new president of the A.W.S., indicated that the American Bureau of Shipping, of which he is principal surveyor, is keeping an exact record of all failures, particularly those occurring in service. He stated that the record of southern yards is no better than northern yards in this respect, although the actual percentage of failures was extremely small.

Longitudinal Welded Joints

Since the strength of longitudinal welded joints have been brought into doubt by some recent failures in ships, A. G. Bissell, Bureau of Ships, Navy Department, reported on some tests made in 1940 at the Naval Research Laboratory on plates 12 ft. long and 12 to 16 in. wide that had been welded longitudinally with regard to the tensile load placed on them in the testing machine. Plate thickness was 7/16 in. These tests definitely prove that longitudinal welds have little effect on the tensile strength of the specimens compared with unwelded plate. In all cases, the break started in the middle at the weld bead and spread outward to both sides of the plate. In many instances the ultimate strength of the welded plate was found to be higher than for the base material, although the elongation was lower. In every case back-stepped welds had been used in the preparation of the specimen.

In the discussion that followed on ship failures in general, it was brought out that too much "closing" welding being done in the outfitting basin often caused failure of welded joints because by this time only large components could be welded together and locked-up stresses would be bound to result. It was suggested by one commentator from the floor that the use of lapped joints would act as a barrier to breaks that might be started at a stress concentration point. Mr. Bissell maintained, however, that lap welded seams do not stop cracks but that a partially welded joint (20 per cent) did cause a definite hesitation in crack dispersion.

Evaluating Weldability

The mechanical properties of weld affected zones were discussed by Lt. S. A. Herres of the Ordnance Department in another paper. He stated that for the ordinary weldment designed to resist single, slowly applied loads, the properties of the weld-quenched zone are of little concern since the yield point of this zone is seldom exceeded before failure occurs in some other part of the structure. Ductility of the weld heat affected zone is considered necessary for weldments designed to resist shock loads, multi-axial stresses or low temperature service. He suggested a nick-break fracture test in order to distinguish zones of intermediately quenched products which are brittle under unfavorable loading conditions; to detect zones which are low in ductility under any conditions, he proposed a slow deformation test.

Lt. Herres stated that four failures are to be avoided, formation of base metal cracks, development of unsuitable mechanical properties in the weld heat-affected zone of the base metal, contamination of the weld metal by elements from the base metal and development of high stresses during welding. Root bracks, which are base metal cracks parallel and close to the fusion zone occur when hardenable alloy steels are welded with ferritic electrodes coated with hygroscopic, organic type coatings. They do not occur when welding with bare electrodes or with electrodes coated with non-hygroscopic, cellulose-free materials.

Root cracking may be explained by assuming that stresses, sufficient to cause the weld-hardened structure to crack, are contributed by precipitation of hydrogen which has dissolved in the weld metal and diffused into the weld heat-affected zone of the base metal during welding. If the steel is sufficiently low in depth-hardening elements, if the ratio of the weld input to the plate mass is high, or if the base metal is preheated to a temperature which will retard the rate of weld quenching sufficiently to prevent full hardening of the weld heat-affected zone during the welding cycle, root cracking does not occur.

Hardenability Effects of Alloying Agents

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IN a combined regional and annual fall meeting, members of the American Institute of Mining and Metallurgical Engineers heard a full and varied program of technical papers in Chicago, Oct. 16 to 20. The Institute of Metals Division program included symposiums on practical aspects of diffusion, and a session on physical metallurgy, while the Iron and Steel Division devoted its portion of the program to refractories, new steel plants, deep drawing, and hardenability. The two divisions held a joint symposium on cohesive strength.

The hardenability session of the Iron and Steel Division, for which four papers were presented, attracted particular interest for the multiplying factors on various alloying elements which were presented.

Multiplying factors for manganese, silicon, aluminum, nickel, chromium, molybdenum, zirconium, vanadium, titanium and boron, for use in calculating the hardenability of steel by Grossman's method, were given in a paper, "The Effect of Some Alloying Elements on Hardenability," by Walter Crafts and John L. Lamont, Union Carbide and Carbon Research Laboratories, Inc., Niagara Falls. These are shown graphically in Figs. 1 and 2. The multiplying factor for a given element was determined as the ratio between the experimentally determined ideal critical diameter and the ideal critical diameter calculated from the other components of the alloyed steel.

The factors behave in a semi-quantitative manner in proportion to the specific effect of the alloys on the constitution of steels. The austenite-forming elements, manganese and nickel, increase the factor in greater proportion as the amount is increeased above a critical value. The magnitude of the respective factors, however, is quite different. The nickel factor is of the same order as those of the other ferrite soluble elements, silicon and aluminum. The manganese factor on the other hand, is similar to

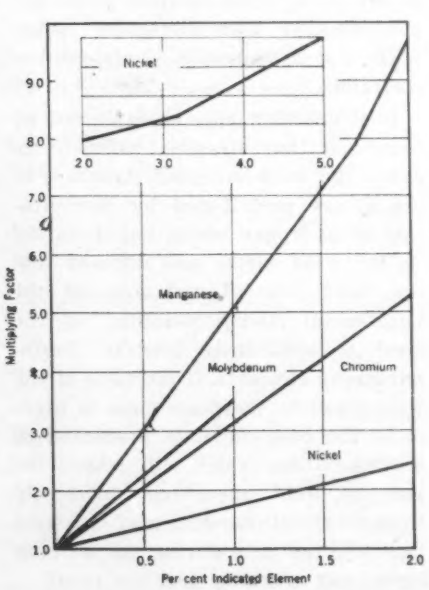

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FIG. 1—Multiplying factors for manganese, nickel, chromium and molybdenum, as presented by Crafts and Lamont.

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FIG. 2—Multiplying factors for silicon, aluminum (acid soluble), zirconium (acid soluble), vanadium, titanium and boron (total), as presented by Crafts and Lamont.

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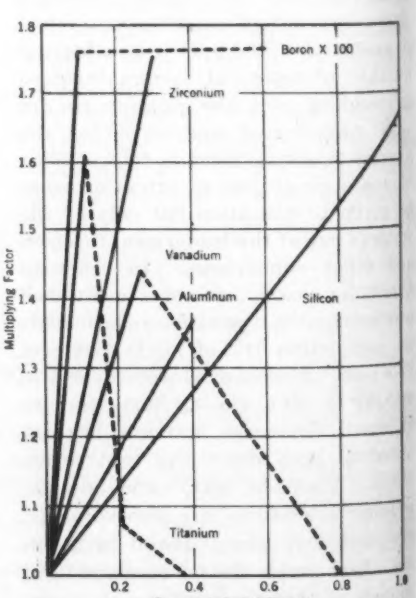

those of the carbide forming elements. The elements usually classed as deoxidizers, titanium, vanadium, and zirconium, increase hardenability in about the same proportion as the carbide-forming elements chromium and molybdenum. The boron factor is of a wholly different order and apparently increases hardenability by a special mechanism.

It is presumed that the negligible effect of boron above 0.001 per cent results from the formation of insoluble iron boride. Unlike vanadium and titanium, the boron compound does not appear to abstract a constituent that affects hardenability, like carbon, so that the hardenability is not reduced by higher boron content. The effect of boron on hardenability did not appear to be affected by the alloy composition of the steel or by the manner of addition, except as the recovery of boron was affected. It appeared, however, that the highest recoveries were obtained with complex addition agents containing vanadium. The only significant observation of a specific influence due to the composition of the steel was that the lower carbon steels (under 0.40 per cent carbon) tended to fall on the high side of the line and that higher carbon steels tended to give lower results.

The consistent manner in which the alloys affect hardenability confirms strongly the validity of Grossman's method of calculating ideal critical diameter. The authors emphasized, however, that the steels on which the factors are based are relatively simple types, and largely in the range of 0.30 to 0.55 C. Experimentally determined ideal critical diameter, especially in low carbon and complex alloy steels, may be only a fraction of the ideal critical diameter calculated from multiplying factors.

The multiplying factors for arsenic, antimony, beryllium, cobalt, columbium, tellurium, tin, aluminum, titanium, chromium, copper, manganese, molybdenum, nickel and silicon, reported in "Effect of Sixteen Alloying Elements on Hardenability of Steel," by Irvin R. Kramer, Robert H. Hafner, and Stewart L. Toleman, Naval Research Laboratory, Anacostia Station, are given in Figs. 3 and 4.

Of considerable interest is the number of different types of alloying elements that decrease hardenability: cobalt, tellurium, columbium and titanium. The decrease of hardenability by cobalt may perhaps be associated with the fact that in the binary iron-cobalt system, cobalt raises the transformation temperature and decreases the hysteresis of the alpha-gamma transformation between heating and cooling.

While titanium and columbium both form stable carbides and nitrides, their individual effects on hardenability cannot be explained in the same manner. The decrease in hardenability due to the loss of available carbon by the formation of CbC or TiC is sufficient to account for the effect of columbium but not of titanium. Tellurium, like sulphur, combines with manganese but its effect on hardenability is far greater than can be attributed to the formation of manganese telluride. Germanium was found to have no effect on hardenability.

The effect on hardenability of nickel, chromium, molybdenum and copper reported by these authors is substantially that reported by Grossman, while that of manganese agrees with results of Crafts and Lamont. Silicon was found to have a greater effect than reported by either Grossmann or Crafts and Lamont.

Quenching Temperature and Test Results

At the same session, Clarence E. Jackson and Arthur L. Christenson, Naval Research Laboratory, Anacostia Station, in a paper entitled "The Effect of Quenching Temperature on the Results of the End-Quench Hardenability Test," reported experimental evidence concerning the effect of quenching temperature on the cooling rates in the end-quench hardenability test.

Typical cooling curves for a distance of ¼ in. along the end-quench hardenability test bar for quenching temperatures of 2100 deg. and 1700 deg. F. are shown in Fig. 5 for 18-8 stainless steel. The effect of quenching temperature upon the time to cool from 1100 deg. to 900 deg. F. for low carbon nickel-steel specimens is shown in Fig. 6.

The authors emphasized that their data established the fact that the quenching temperature for the end-quench hardenability test bar is important, especially for steels of low hardenability. The cooling rates follow closely the relative cooling rates predicted by the ideal quench at distances close to the end of the bar. The effect of quenching temperature beyond ½ in. is less important. This effect is not great for the narrow range of temperatures used in ordinary hardening, but is present and should not be neglected in comparative hardenability studies. The comparative end-quench test results reported in this paper were obtained on specimens that had undergone the same maximum austenitizing temperature that minimizes the effect of variations in the degree of carbide solution that ordinarily affect hardenability measurements.

Except in a few isolated instances,

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FIG. 3—Multiplying factors for manganese, chromium, silicon, nickel and copper, as presented by Kramer, Hafner and Toleman.

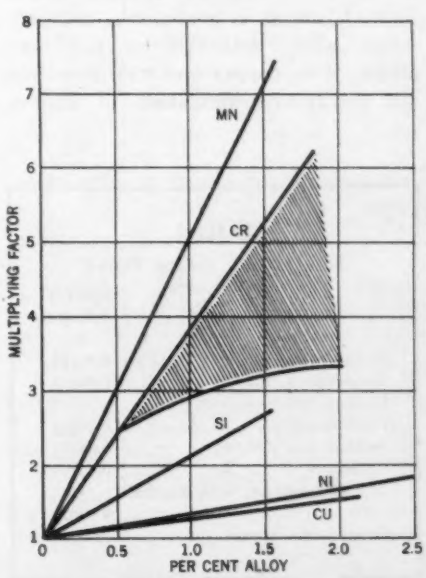
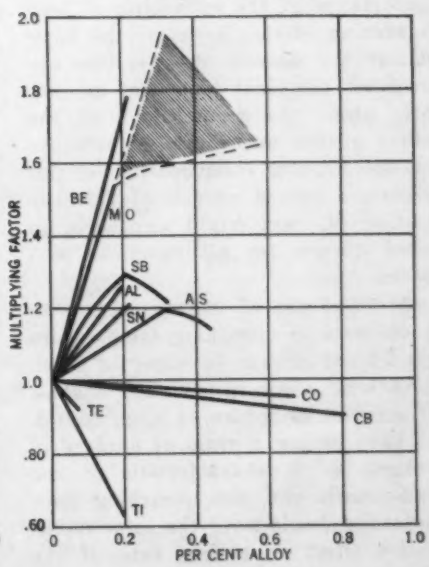


FIG. 4—Multiplying factors beryllium, molybdenum, antimony, aluminum, tin, arsenic, cobalt, columbium, tellurium, and titanium, as presented by Kramer, Hafner and Toleman.



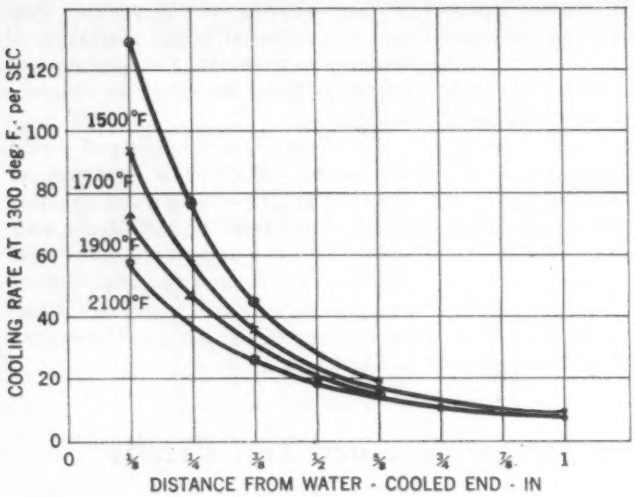


FIG. 5—Effect of quenching temperature on cooling rate at 1300 deg. F. for end-quench hardenability test specimen of austenitic stainless steel.

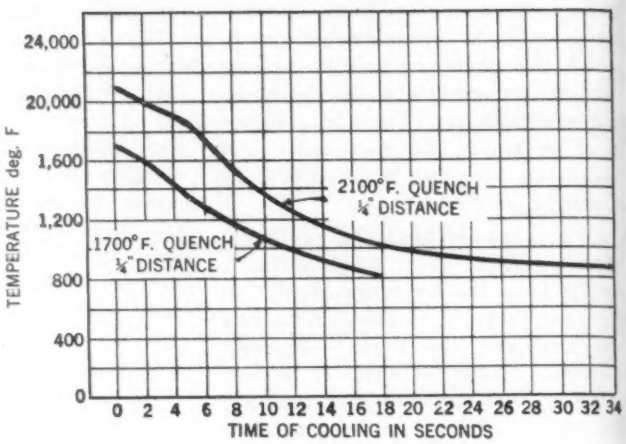


FIG. 6—Time-temperature relation for 1/4 in. distance on end-quench test bars from low alloy steel.

the quenching temperature had little effect on the hardenability of deep-hardening steels; because the half-hardness point for deeper hardening steels occurs at such a distance along the end-quench hardenability bar that there is little or no difference in the severity of quench for various quenching temperatures. In an ideal quench of an infinite plate (severity of end-quench factor being infinite and air cooling negligible) the relative cooling rates when quenching from various temperatures are independent of distance from the surface of the plate. In the end-quench test, as the severity of end-quench decreases in value and the air-cool factor increases, the relative cooling rates will depend upon the distance from the quenched end of the bar, and the quenching temperature will have less effect as the distance becomes greater.

It is to be expected that the effect of quenching temperature on the end-quench test will assume its greatest importance in the quenching of low-hardening steels; however, the more nearly the quench of a section approaches the ideal quench of an infinite plate, the greater will be the effect of the quenching temperature on the cooling conditions. For instance, a severe quench of a heavy section of steel might approach an ideal quench for all practical purposes.

The increase of cooling rates with a decrease in quenching temperature should not always be expected when quenching other geometrical shapes. If a round, or sphere, is large enough to have as low a ratio of surface to volume as is characteristic of the end-quench bar, the quenching temperature should have the same qualitative effect on cooling rate, if the ratio of surface to volume is high, the effect of quenching temperature may be in the opposite direction. In all cases, the effect of quenching temperature will depend on the size and shape of the quenched specimen and the severity of quench factor, which determines the amount of heat the coolant will remove from the surface of the quenched specimen.

Diffusion of Indium from Bearing Surfaces

Among the papers presented in the Institute of Metal's symposium on practical aspects of diffusion was a report on "Diffusion in Indium Plating," by A. A. Smith, Jr., American Smelting & Refining Co. The author pointed out that undoubtedly the effectiveness of the indium plate in resisting corrosion depends upon its relative concentration on the bearing surface after the diffusion treatment and after prolonged use at operating temperature. Table I lists the various base metals that were indium plated and the thickness of the indium plate. It was found that the depth of diffusion of indium is greatest in the cadmium alloy, followed by the lead alloys. With copper and sterling silver the depth of penetration of indium was relatively slight, the concentration approaching zero at only a few thousandths of an inch from the interface.

TABLE I

Base Metals, Indium Plated

Alloy	Thickness of Plate, In.
Refined lead (99.99)	0.00197
Cadmium + 1.3 Ni	0.00220
Oxygen-free copper	0.00242
Sterling silver	0.00212
Refined lead (99.99)	0.00011
Cadmium + 1.3 Ni	0.000097
12.5 Sb, 3.0 As, 0.75 Sn, bal. Pb	0.0001
Oxygen-free copper	0.00008

Diffusion Constants Questionable

The constitutional diagrams for copper - indium, silver - indium, and lead-indium indicate a large solid solubility of indium. The solid solubility of indium in cadmium has not been determined but undoubtedly there is an appreciable amount, as indicated by the diffusion experiments.

Because of the limited number of diffusion data and the lack of precise solid solubility limits in indium alloys, the calculation of diffusion constants appears questionable and of little value, the author believes.

In all cases the concentration of indium at the surface remains relatively high even after the more drastic diffusion experiments. It has been indicated that even as low as 0.37 per cent indium alloyed with cadmium-bearing metals will markedly decrease the rate of corrosion in acidified lubricating oils. If that is true, these data indicate that extremely long times would be necessary before diffusion would progress to such an extent that the indium content at the surface would be below this amount, assuming that the weight of indium is less than 0.4 per cent of the weight of the base metal.

Screw Machine Steels

IN the second section of the article "Screw Machine Steels as Alloy Steel Substitutes," by A. S. Jameson, of International Harvester Co., which appeared in the issue of Sept. 23, Tables IV, V and VI were not included. Because of the number of requests for these data, the missing tables are reproduced herewith:

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TABLE IV—List of Medium Carbon-Sulphurized AISI Steels

AISI No.	Chemical Composition Limits,* Per Cent						
	Carbon		Manganese		Phosphorous	Sulphur	
	Min.	Max.	Min.	Max.	Max.	Min.	Max.
C 1137	0.32	0.39	1.35	1.65	0.045	0.08	0.13
C 1141	0.37	0.45	1.35	1.65	0.045	0.08	0.13
C 1144	0.40	0.48	1.35	1.65	0.045	0.24	0.33

* No silicon content is specified. It is understood that where a minimum silicon content is desired special melting practice will be required.

TABLE V—Hardenability in Terms of Bar Size

AISI No.	Austenitic Grain Size at 1700 deg. F.	Maximum Size in Which Rockwell C 45 Would be Obtained at the Surface	Maximum Size in Which Rockwell C 45 Would Be Obtained at Center
		Oil	Oil
C 1040	Fine	3/4	1/16
C 1045	Fine	7/8	3/32
C 1137	Coarse	1 3/8	1/2
C 1141	Fine	1 1/8	3/8
C 1141	Coarse	1 3/4	3/4
A 4042	Fine	1 1/2	5/8
A 3140	Fine	2 5/8	1 1/4
A 4140	Fine	3 1/8	1 1/2

TABLE VI—Average Tensile Properties After Quenching in Oil at Various Temperatures and Tempering at 900 Deg. F.

A.S.T.M. 0.50 Test Bars
Fine Grained Steel
C 0.34, Mn 1.48, S 0.11, Si 0.18

Quenching Temperature, Deg. F.	Yield Point, Lb. Per Sq. In.	Tensile Strength, Lb. Per Sq. In.	Elongation, Per Cent in 2 In.	Reduction of Area, Per Cent	Hardness		"P" Value
					Rockwell C	Brinell	
1500	130,000	141,000	18.0	58.0	26	255	98
1550	130,000	142,000	18.5	59.0	26	255	99
1600	131,000	142,000	18.5	59.5	26	255	100
1650	130,000	141,000	18.0	59.0	26	255	99
1700	125,000	138,000	17.5	58.5	26	255	98

Coarse Grained Steel
C 0.36, Mn 1.34, S 0.12, Si 0.24

Quenching Temperature, Deg. F.	Yield Point, Lb. Per Sq. In.	Tensile Strength, Lb. Per Sq. In.	Elongation, Per Cent in 2 In.	Reduction of Area, Per Cent	Hardness		"P" Value
					Rockwell C	Brinell	
1500	142,000	155,000	16.0	55.0	30	285	97
1550	142,000	155,000	15.5	55.0	30	285	97
1600	141,000	155,000	15.5	54.0	30	285	96
1650	141,000	155,000	15.0	53.0	30	285	95
1700	140,000	155,000	15.0	51.0	30	285	92

The "P" value is calculated from the formulae, $P = \frac{TS + 6000\ RA}{5000}$

Casting Die Wedges for Light

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CONVEX flanges on light metal sheets are being formed without wrinkles at the Inglewood, Cal., plant of North American Aviation, Inc., through the use of die wedges on a restrike operation on a hydropress.

Use of this wedge has eliminated wrinkled flanges, placed the wrinkles in a set location and enabled joggles to be successfully formed in the flanges. It has thereby eliminated the hand bench labor of shrinking wrinkled flanges and the hand forming of joggles.

The basic principles of the die wedge used in conjunction with an auxiliary "dam" in the forming die has already been explained.* This article carries the work from the laboratory proving ground into actual production and deals with the problem of making the wedges, working from the die as a master pattern.

*See "Control of Flange Wrinkles in Hydro-Press Forming," THE IRON AGE, p. 40, Sept. 30, 1943.

The forming die used on the hydropress is of Masonite construction, hence before the die is changed or a new die is ordered, a number of important factors concerning the part to be fabricated must be taken into consideration. Chief items in this respect are: (1) outside flange radius, (2) inside flange radius, (3) metal thickness, (4) metal hardness, (5) flange depth and (6) fabricated condition of proposed flange.

In order to control the flanges while forming parts on a hydropress it is necessary to add the following to the present form die:

1—Bottom plate of Masonite
2—Masonite dam (also called a trap)
3—Die wedge of Kirksite "A"
4—Pins in trap for locating die wedge
5—Pressure plate
6—Second operation on the hydropress

The sketch in Fig. 1 shows in large detail (not to scale) the relative position of these parts, while Fig. 2 illustrates the specific parts discussed in this article. A, in Fig. 2, is the trap (trap and dam are synonomous). B is the die wedge, while C is the formed part.

Considering the six factors individually, the bottom plate of Masonite is needed to support the form block and the parts or accessories which control the flange and to strengthen the die generally. The size of this plate can be determined by taking the following dimensions into consideration:

1—Thickness of the plate must be a minimum of 0.5 in.

2—Length of the plate must be the length of the formed part plus a minimum of 1.5 in. (0.75 in. on each side). This additional material in the plate acts as a safety factor in case the die should move on the bed plate. Should this occur, the additional material will keep the forming section of the die clear of any other forming die or obstacle during the forming operation.

3—The width of the plate must be the width of the form block, plus the maximum depth of the flange, 0.625 in., plus the 30-deg. angle of the dam (this is standard), measured from the horizontal plane, plus a minimum of 1.25 in. for the width at the top of the trap.

Practical experience has proved the application of the bottom plate to be an essential requirement in this forming process and satisfactory results can be obtained if these dimensions are adhered to.

o o o

RIGHT

FIG. 2—This view shows various parts of the forming die. A is the dam or trap, B is a Kirksite wedge and C is the formed part.

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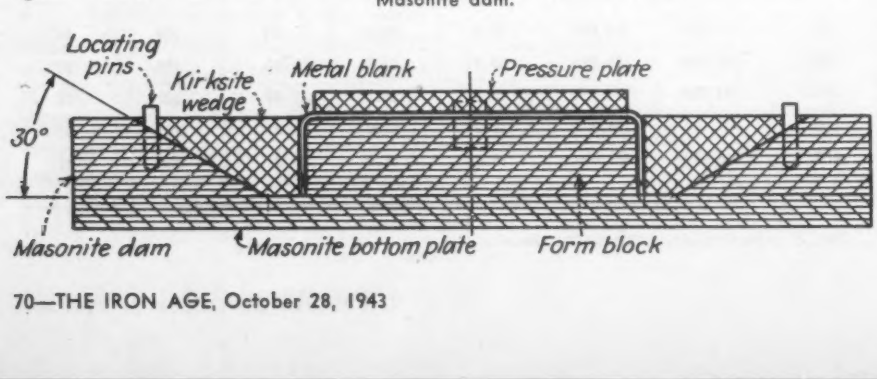
The addition of a trap of Masonite to the bottom plate of the form block is an important step, since the die wedge is located in this trap. With the 60-deg. angle (measured from the vertical) to the inside wall of the trap, the movement of the die wedge is directed against the flange of the formed part when pressure is applied against the die wedge. The length of the trap is the same as the form

FIG. 1—Small locating pins are used to position the Kirksite die wedges on the Masonite dam.



Metal Flanging

By LEONARD C. COSTELLO
Procedure Control Analyst,
North American Aviation, Inc.,
Inglewood, Cal.

. . . Use of a wedge in the dam of a hydraulic press die for controlling flanges in light metal forming is meeting with considerable success in this aircraft plant. This article details the technique used in casting this die wedge in Kirksite.

block; the width is a minimum of 1.25 in. at the top, plus the 60-deg. angle of the inside wall.

The dam (see Figs. 1 and 2) is formed by the 60-deg. angle (measured from the vertical) on the inside wall of the trap and the outside wall of the form block. This dam is the seat of the die wedge and controls its movement.

The die wedge (see Figs. 1 and 2) used with the Masonite form block is

cast from Kirksite A, a zinc alloy. Fabrication of the plaster pattern of the die wedge requires very little preparation on the part of the plaster pattern maker. Nevertheless this pattern is of paramount importance, for any error in its construction can result in distortion of the forming die and the sheet metal part, or the destruction of one or both.

When the Masonite form die is received in the plaster pattern shop, the first operation is to give the dam a coat of Stearine, since this section of the die will be used as the shell or model for the plaster pattern. Stearine is applied to prevent the moist plaster mixture from adhering to the Masonite dam. A block of Kirksite 2 x 2 x 4 in. is placed at each end of the dam to keep the moist plaster mixture enclosed in the dam of the die. The inside wall of these blocks is also given a coating of Stearine. The weight of these Kirksite blocks is sufficient to hold the moist plaster in the dam area.

Strips of modeling clay 0.25 x 0.50 in. are placed along the edge of the dam to provide for shrinkage of the plaster and the molten Kirksite in the setting up and cooling periods. These strips are made from bulk modeling clay rolled to the 0.25 in. height and then cut into strips 0.5 in. wide. At this point the dam is ready for the moist plaster mixture.

The cavity caused by the Kirksite blocks and the modeling clay strips is filled with moist plaster to the top of the clay strips, as in Fig. 3. A period of 20 min. is required for the setting of the plaster mixture.

Removing Plaster Patterns

Just before the plaster mixture has set, the plaster pattern is cut into two or three sectors in order that the wedge sections will be of a weight and length easy to handle and of a size to conform with the conditions controlling the forming of the flange of the sheet metal part. This size, for handling reasons, should not exceed 12 in. in length and 10 lb. in weight.

To remove the plaster pattern sections of the wedge from the dam of the die, two pins approximately 5 in.

LEFT
FIG. 3—Pouring the plaster mix into the wedge patterns.

RIGHT
FIG. 4 — Molding the wedges from plaster patterns.

FIG. 5 — Pouring Kirksite into a mold of wedges. Note the use of weights.

long by 0.125 in. in diameter and pointed on one end are pressed into the pattern of the die wedge. When the plaster has set and is rigid, the pattern is lifted from the dam by means of these two pins. The pins are removed from the pattern after they have served this purpose.

The plaster pattern is then cleaned of all excess plaster and brought to a very smooth finish, keeping in mind that the pattern must include sufficient material to allow for the shrinkage of the Kirksite. The pattern is now given two coats of quick-drying shellac.

At this point the pattern is ready for the foundry. Experience has proved that the best method of casting the wedges is in a two-part flask, with several wedges in each mold. It is advisable to keep the wedges at least 3 in. from the edge of the flask to avoid runouts.

Locating Pins in Dam

The wedges are molded in the drag section, as shown in Fig. 4, using a well-sifted facing sand. The gates are cut in the cope with a 1-in. tube. Practice has indicated that better results are obtained if each wedge is separately gated. A bob about 2 in. deep is placed in the drag, which feeds to the casting through a runner 0.5 in. long by 0.75 in. deep. The mold is weighted before pouring.

Pouring, Fig. 5, is usually more economical by hand ladle. After pouring, 2 hr. should be allowed for cooling and setting of the wedges. Then follows the usual finishing operations.

A smooth ground finish is given the die wedge and then pins 0.25 in. in diameter are located at the edge of the dam to act as guides to the die wedges when the wedges are under pressure of the rubber in the forming operation. The die wedges are notched to fit these pins.

One of the principal accessories of the hydropress Masonite forming die is the pressure plate. Since the pressure exerted by the caged rubber in the head of the press against the die wedge has a tendency to distort or twist the radius of the flange, a pressure plate is placed on the form block of the die.

This pressure plate is held in place by the same tool pins that are used to hold the sheet metal part to be formed. This plate should be 0.25 in. Kirksite or 0.5 in. Masonite. It is fabricated to the same angles and top dimensions as the form block. As pressure is applied to the die wedge, the same force acts on the pressure plate, which rigidly holds the sheet metal part to be formed so that the exact radius on the form block will be duplicated on the sheet metal part.

The method of using the die wedge is as follows: The first forming operation on the sheet metal part, which at this point is either blanked or routed, is to place the part on the die, attach the pressure plate and then set the forming die under the caged rubber of the hydropress. Pressure is applied and the flange is formed on the sheet metal part. However, since the springback of the part cannot be sufficiently controlled by the pressure of the caged rubber, the true contour of the flange will not be produced.

True Contour Produced

To produce this true contour, a second operation is performed by releasing the pressure on the die and inserting the wedges, Fig. 6. Then the form die is again set under the rubber and pressure applied against the wedge, which in turn transmits the pressure to the flange, producing a true contour radius and angle. Fig. 7 shows frame and rib sections typical of parts which can be formed with located wrinkles.

It was originally intended to have reliefs or cutouts in the form block to locate the formed wrinkles at set points, to permit absorption and distribution of the excess metal. These reliefs presented quite a study. For

FIG. 6—The die arrangement for the second forming operation, showing the wedges (indicated by arrows) in place. The blank is held in position by the two guide posts. The pressure plate is not shown.

example, when the material in the sheet metal part was altered to a new thickness or hardness, it required a new forming die.

In addition, all given thicknesses and hardnesses do not have the same reaction when reliefs are inserted in the form block and the die wedges. Instead, with the cooperation of the engineering department, it was arranged to place slots or cutouts in the flange of the formed part which in fabrication of the flange accepted the excess material, thereby eliminating wrinkles. This method has worked out satisfactorily. Some of these slotted flanges may be seen in Fig. 7.

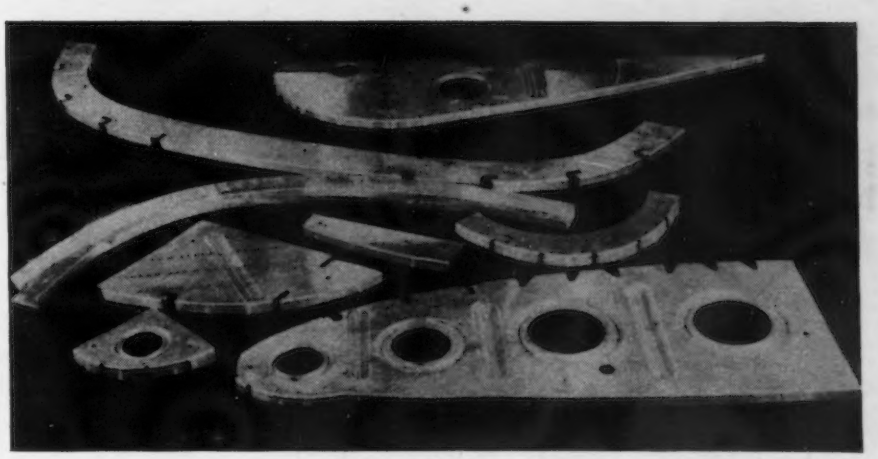


FIG. 7—Frame and rib sections typical of the types of parts which can be formed with located wrinkles.

Austenitic Manganese Steels For Exhaust Valves

NUMEROUS tests have been carried out in Germany to determine the relative merits of austenitic chromium manganese nickel steels and austenitic chromium nickel steels for airplane engine exhaust valves. D. W. Rudorff in *Metallurgia* of April, 1943, gives an account of this investigation.

A 15-13-2 chromium nickel tungsten steel with 0.74 per cent manganese was taken as a basis and its properties were compared with those of 14 other chromium nickel steels containing up to 8.86 per cent manganese. Tensile, impact, hardness, wear resistance, scaling, nitriding and creep tests were carried out. No relationship between either hardness or grain size and wear resistance could be established. While the steels high in manganese exhibited slightly greater wear than the others, these wear tests were not regarded as conclusive.

Six methods of nitriding were tested and the difficulties encountered in the nitriding of high manganese alloy steels were overcome by the cadmium-phosphate treatment. The thickness of the nitrided layer decreased with increasing nickel contents; the carbon content having had little effect on this thickness. Once the conditions for the successful diffusion of nitrogen into the material has been established, the inhibiting effect of manganese is less than that of nickel. The partial replacement of nickel by manganese had no adverse influence upon the scaling properties of the steels tested.

The divergence of the hardness values of all the steels at room temperature decreased considerably with increasing temperature in tests at up to 1650 deg. F. Tungsten can safely be replaced by vanadium without impairing the creep strength, but the vanadium content should not be more than 0.5 to 0.6 per cent because of its adverse effect on scaling.

The final conclusion drawn from these tests was that a material containing 0.42 to 0.52 C, 1.5 to 2.0 Si, 3.0 to 5.0 Mn, 6.0 to 4.5 Ni, 17.5 to 18.5 Cr and 0.9 to 1.3 W should prove a very satisfactory valve steel.

New Developments in Greases

SOAP-containing greases are among the most commonly used lubricants for the bearings of heavy engines of war and industry, but new developments are being constantly made in them. One recently patented grease, said to be resistant to water, contains a lead soap as well as a sodium soap. The product is made by saponifying fish oil, dissolved in lubricating oil, with litharge, and then with lye at a higher temperature. It is especially suitable for open machinery since it is so tenacious and resistant to centrifugal force.

Another recently proposed soap-containing grease contains a lithium soap which improves its resistance to water, pressure, and heat. Additional sodium soap is included to make a total of about 40 per cent soap.

The presence of even a small amount of water in soda-base greases renders them useless at high temperatures, presumably because of the formation of steam. However, if this water be driven off by heating the grease to high temperatures previous to use, a crumbly material of poor texture results. To prevent this it has been suggested that a plasticizing agent, such as glycerine or oxygenated pitch, should be mixed in. A typical formula contains 40 to 50 per cent tallow soap, 40 to 50 per cent oil and 2 per cent glycerine.

In high temperature operations hot grease is slowly oxidized by air with the production of a hard crust which seriously interferes with lubrication. To prevent this oxidation, inhibitors, such as phenols or amines, are added. Chemists have learned recently that the action of these inhibitors may be enhanced by using the phenols in those greases which are slightly acid, and the amines (naphthylamines) in those which are slightly alkaline. As little as one-tenth per cent is sufficient to prevent this crust formation.

Cleaning Machine Gun B

CLEANING the millions of metal belt links for 0.30 and 0.50 cal. machine gun cartridges produced each day has been a formidable task for American industry, a task made more difficult by the high standards of quality demanded by the Army in each link. The National Stamping Co., Detroit, one of the largest producers of these links, has developed an unusually efficient setup for cleaning these links. The heart of this setup is a battery of six 27 x 36-in. airless Wheelabrator abrasive blasting units made by the American Foundry Equipment Co., Mishawaka, Ind. These machines are equipped with rubber conveyor belts, time clocks to regulate the duration of the blasting period and ammeters for determining input of abrasive. By exercising close control over abrasive use and handling, National Stamping is able to clean 5000 0.50 cal. or 20,000 0.30 cal. links at a grit cost of 12.65c. The accompanying photographs illustrate some of the time and labor saving arrangements employed in National's cleaning setup.

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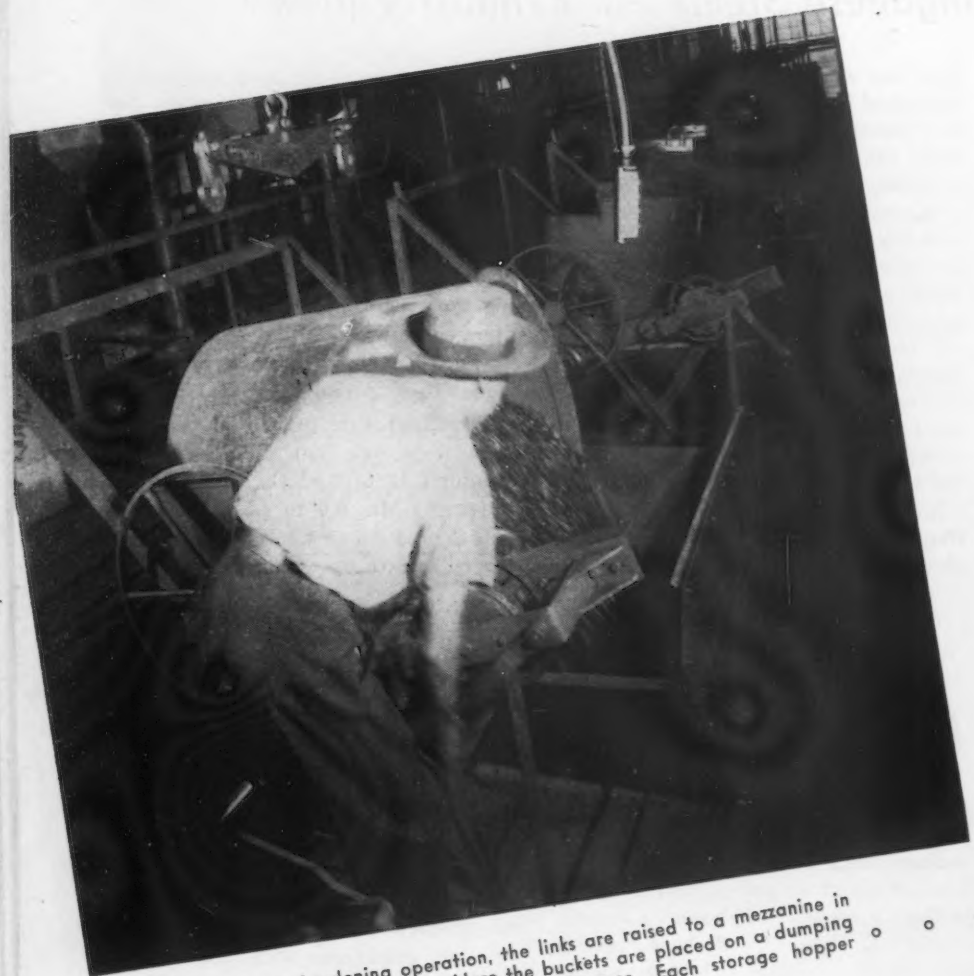

FIG. 1—Following a hardening operation, the links are raised to a mezzanine in buckets of 800 to 900 lb. capacity. Here the buckets are placed on a dumping rack, which discharges the links into a storage hopper. Each storage hopper holds four to five bucketloads.

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FIG. 2—From the storage hoppers located over the Wheelabrator mills, the links are fed into skip hoist loaders for charging into the mills. The balanced spout from the storage hopper may be manipulated to assure that each skip load is always very close to 5 cu. ft., or 20,000 0.30 cal. links, or 5000 0.50 cal. links.

Belt Links . . .

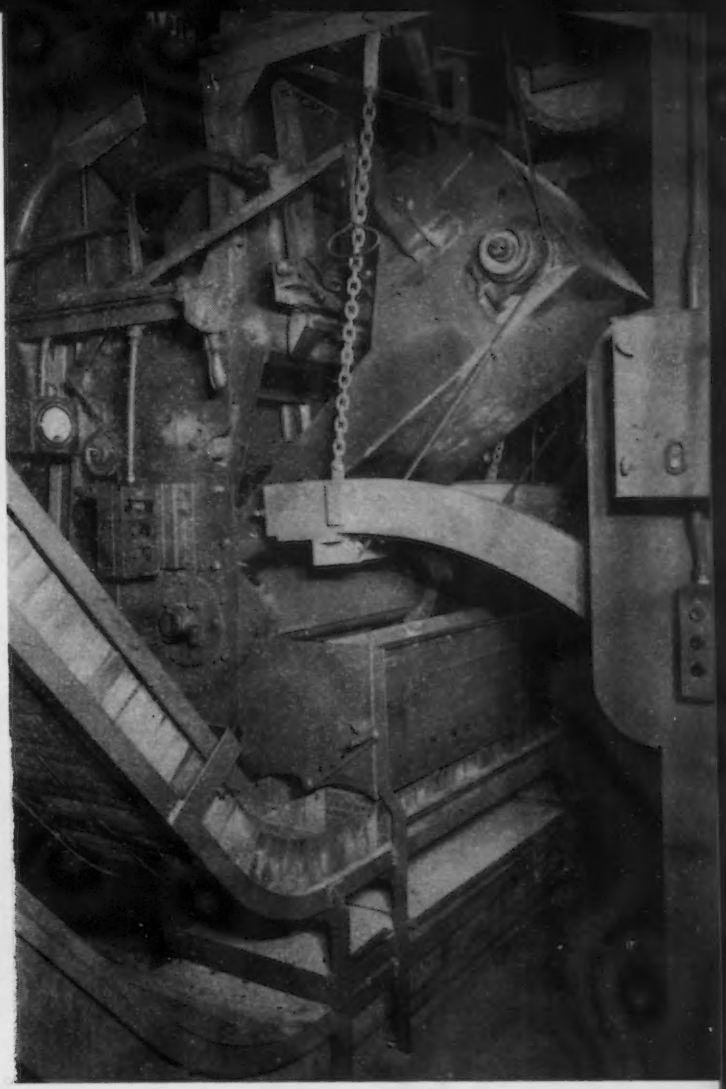

FIG. 3—After the mill hoist loader is filled, push button controls raise the hoist and load the mills. Each mill can handle four to five loads an hour on the following operating cycle; loading time 5 sec.; blast on for 10 min.; blast off 1 min. but mill kept working to sift out reusable abrasive; unloading time, 30 sec.

o o

ABOVE

FIG. 4—After the cleaning cycle, the mill is reversed and the links discharged onto a two-line conveyor which carries them to storage hoppers on the mezzanine. From these hoppers, the links move by gravity to draw furnaces or Parkerizing drums. The conveyor belt shown in this photograph has a wire mesh bottom to allow excess abrasive to drop through. The hopper immediately beneath the mill discharge apron has a two-way baffle, operated by a hand lever, to permit control of the flow of links onto one or the other conveyor lines.

o o o

RIGHT

FIG. 5—This general view of the cleaning department shows the mezzanine, the mills and, in the foreground, the storage hoppers for cleaned links. Only one operator is required on the floor level to operate the six Wheelabrators. The entire setup requires the attention of an average of only 1.8 operators, including periodic foreman supervision and labor for handling abrasive. The stamping company reports that abrasive usage, with 10 min. blasting time per load, averages about 3 1/3 lb. per load.

Surface Grinding Worm Thread Cutters

BY R. J. THIMINEUR
Schenectady Works, General Electric Co.

GRINDING the flanks of a 14½-deg. worm thread milling cutter on a surface grinder, using a special angular fixture. The indexing finger can be seen at the end of the permanent magnet holder.

MAINTENANCE of required production, accuracy, and finish on a small worm thread was becoming an increasingly difficult problem, due to the existing method of grinding the disk type milling cutters and the periodic breaking in of new machine operators. Form-ground worm cutters, which are resharpened by grinding on the face of the teeth, were tried, but these did not prove satisfactory as a burr was raised on one edge, and also because the flank angles were subject to modification as grinding proceeded. These cutters were being ground on a machine with a disked wheel and it was difficult to maintain the proper pressure angle on the cutter. This method and the normal grinding setup resulted in "cross lines" or improper finish on the cutter. Consequently, a worm thread machined by the cutter resulted in an unsatisfactory thread-milling job.

A new fixture, with required cutter angles for mounting on the magnetic chuck of a surface grinder, was constructed by altering a standard permanent magnetic V-block. Worms of either 14½ or 20-deg. pressure angles are cut. Hence fixed angle blocks are provided for each type of cutter. This angle block is held on a standard magnetic chuck on the table of the surface grinder as shown in the illustration, and in order to prevent the flux from this chuck getting into the permanent magnet V-block, a brass plate about ½ in. thick is interposed between the latter and the angle block. Obviously all three elements are mechanically one unit, being held together by cap screws.

It is necessary to provide a fixed center for location of the disk cutter during regrinding. This is accomplished by means of a sliding brass shoe or locating plug which is set screwed in position in a dovetail in the top of the V-block. Adjustment is necessary to take care of cutters of various diameters. The dovetail is formed by reversing the top pieces that normally form the V. When the cutter is located on this plug, the flank of the topmost tooth is in a horizontal plane and is traversed under the grinding wheel in this position. An indexing finger, made of brass and spring controlled, serves to locate each successive tooth under the wheel.

The worm cutter being resharpened is held by turning the permanent magnet to the "on" position. It is not necessary to demagnetize during indexing as there is only sufficient magnetic force to hold the cutter securely.

The fixture is used in conjunction with a special high-speed grinding attachment built to use small grinding wheels in sizes of ½ to 1-in. diameter. With the new fixture and machine attachment, the former undesirable cross lines showing in the worm cutters now run parallel to the face, thus eliminating them in the more smooth and accurately finished worm, as well as extending the life of each cutter.

Formerly, accurate grinding of the 14½ and 20-deg. pressure angles was entirely dependent upon the exact setting of machine graduations by the operator.

During the use of the former method of grinding these worm cutters, a maximum of only 16 worm threads could be cut without changing or sharpening the cutter. It is now possible to cut 32 to 35 worm threads between grinds with the same cutter.

to hold that line—

OILGEAR

In this welding positioner Oilgear Fluid Power solved 6 difficult design problems.

on a 50-ton steel shape or on a sheet of cellophane

THERE is a world of difference between holding the hairline register in printing flimsy cellophane and holding a line in the automatic welding of a 50-ton steel shape. But the fact that Oilgear Fluid Power has solved these and far more varied problems makes it seem certain *your* particular problem will yield to the versatility and flexibility of this proven power application system.

Here are just a few of the functions Oilgear Fluid Power will provide . . . steplessly and infinitely variable speed control of moving members . . . force *without* movement . . . a simple means of applying great power . . . the synchronizing of a number of motions . . . perfect sequence or cyclic operation.

For a quarter of a century Oilgear Engineers have applied these and other Oilgear Fluid Power functions to hundreds of different machines and mechanisms in hundreds of different ways . . . with results which often have been amazing. Oilgear Engineering know-how and Oilgear Fluid Power adaptability may provide just the answer you are looking for in that machine you are going to bring out. Now is the time to see. The Oilgear Company, 1303 W. Bruce St., Milwaukee, Wis.

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2. Obtain automatic work cycles, variable speeds in either direction . . . with or without pre-set time dwell?
3. Apply large forces through continuous or intermittent reciprocating cycles at constant or variable velocities?
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6. Closely synchronize various motions, operations or functions?
7. Apply light . . . or heavy . . . forces at extremely high velocities through either long or short distances of travel?
8. Obtain continuous automatic reversing drives at constant R P M or over a wide range of speed variation?
9. Obtain accurate remote control of speed and direction of rotation, rates of acceleration and/or deceleration?
10. Obtain constant horsepower output through all or part of a speed range?
11. Obtain automatic torque control?
12. Obtain accurately matched speed of various rotating elements?
13. Obtain constant speed output from a variable speed input?
14. Obtain full pre-set automatic control, elimination of problems of shock, vibration, etc.?

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Fluid Power

Assembly Line . . .

STANLEY H. BRAMS

• Automotive industry's objections to procedure on contract terminations are entered at Washington . . . Industry indignation runs high against GAO reviews . . . Case histories relate intimidation on profits.

DETROIT—A good share of industry's most concentrated postwar thinking today revolves around contract termination. Automotive industry heads particularly believe that the prompt settlement of war contracts as they run out is the most important single factor now existing in forward planning. This viewpoint underlaid these sentences in a letter written earlier this month from the Automotive Council for War Production to Lindsay C. Warren, federal comptroller-general:

"It is paramount in the public interest that . . . settlements be arrived at promptly, and that in the absence of fraud, the settlements reached be final and conclusive, if the reconversion of industry to civilian peacetime pursuits is to be accomplished without a concomitant period of industrial stagnation comparable to that prevailing in the depths of the worst depressions this country has ever experienced.

"Our experience with General Accounting Office audit procedures now in effect is the basis for our opinion that if they were to be generally applied to a problem of the magnitude which will be created by the contract terminations at the end of this war, they would constitute an insuperable obstacle to the resumption of wide scale industrial activity within reasonable time."

The letter to Mr. Warren containing these remarks followed a visit made by members of the Automotive Council's Contract Termination Committee during which the industry's position was outlined. Indicative of the importance attached to this meeting was the makeup of the group which visited the GAO—James H. Marks, vice-president of Packard and chairman of the committee; E. R. Breech, president of Bendix; K. J. Ammerman, assistant to the president, Borg-Warner; W. F. Armstrong executive vice-president of Nash-Kelvinator, and B. E. Hutchinson, executive vice-president of Chrysler.

If these worthy gentlemen did any plain talking to Mr. Warren, it follows that their meeting was very likely a highly interesting one, because complete disgust with GAO procedures is fast becoming the rule in Detroit. Perhaps this is somewhat misplaced, but it is a fact that at the end of the renegotiation road the General Accounting Office looms up as the last and largest obstacle. Corporate travelers down this rocky pathway are so worn and bruised by the time they arrive at the final hurdle that the last scars are the hardest and keenest of memory.

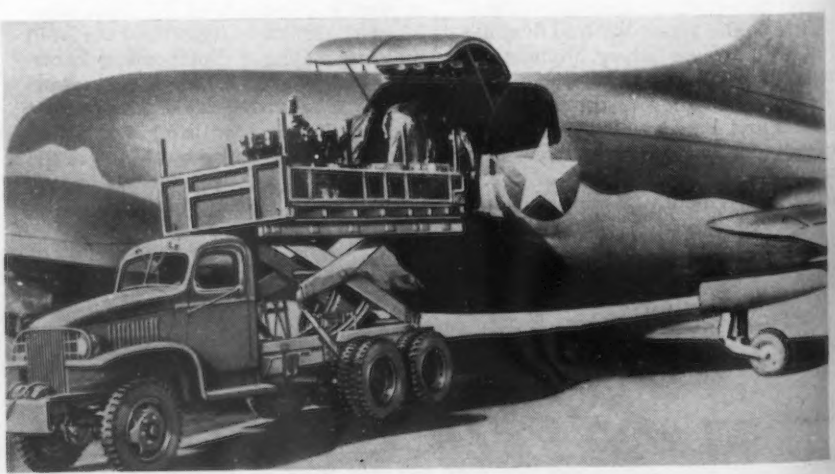
INDIGNITY over contract renegotiations and terminations—the two are tied together almost inextricably—cannot be measured accurately, although it is obviously high, because the first prohibition laid on renegotiators and termination negotiators is complete silence. The government line in these matters is that each case is considered on its merits, and the conclusions applicable do not necessarily apply to any other matter. Pressure is then put on the company to remain silent on any conclusions reached, because if it is learned the subject company is treated more favorably than another concern in the same field, that other concern's outcry might force reconsideration of the subject company's net return! Companies remain quiet, therefore, and never positively know just how they fared in contrast to others.

Furthermore, little choice is offered any negotiating company on proposals set before it by a district price adjustment board. The case histories are beginning to be whispered in Detroit, and here is one such:

Company officials were summoned and told that net profits were to be cut far below indicated levels, and well below normal return. This offer, officials were told, was one which had to be taken up at once. Otherwise, this company was plainly told, payments on current contracts would be cut off, and no more contracts would be awarded it, thus effectually throwing the concern out of business. The officials asked time to consider the matter with their attorneys and accountants. The local P. A. B. men said that the offer—if the proposal could be considered by any word so sweet — was on a take-it-or-leave-it basis, that no accountants or lawyers were wanted in the picture. Nevertheless, this firm walked out of the meeting and took up the matter with its advisers. The advisers find little recourse available.

THE uncertainties of contract terminations were well illustrated in the thinly publicized hearings of the House of Representatives Ways

GIANT CURTISS COMMANDO of the Air Transport Command, U. S. Army Air Forces, is being loaded by a Hi-Lift Plane Loader, made by Gar Wood Industries, Inc., Detroit.



THROUGH ALL THE RUSH

Pratt & Whitney thread gages in every style and size, such as the one shown here, are meeting the demands of war-time rush with pre-war dependability.

One Name Still Holds Its Meaning

SYNONYMOUS with "dependable accuracy," the P&W name has lost no shade of its pre-war meaning. Now as then, Pratt & Whitney gages go forth to serve with unimpaired precision. A rock upon which industry can count in difficult production problems, P&W machine tools, small tools and gages remain true to their name and reputation.

PRATT & WHITNEY

Division Niles-Bement-Pond Company

WEST HARTFORD, CONNECTICUT, U. S. A.

and Means Committee last month. Automotive executives and many others in turn poured out tales of woe.

Willard F. Rockwell of Timken-Detroit Axle Co. told his story midway through the hearings. In one respect his tale paralleled that of the small unnamed company which was high-pressured in Gestapo-like fashion before the district Price Adjustment Board. Said Mr. Rockwell, speaking of officials of the Army renegotiation group:

"Their so-called renegotiations consisted of reflections on our patriotism and thinly veiled threats to attack officers' salaries and take over management, with open threats to order agencies to cancel our orders and withhold new business."

Thereupon, reported Mr. Rockwell to the House Committee, the first meeting with the district P.A.B. produced the government suggestion that the company should refund between $9,000,000 and $12,000,000. At the next meeting exactly $10,000,000 was demanded — quite obviously, as Mr. Rockwell put it, a "capricious figure," one that could never have been thus exactly derived by study of the facts in the case. Finding that its arguments on costs, production records, and evidences of manufacturing ingenuity availed not at all, the company finally agreed to refund $10,000,000. After several months, company executives were called to Washington, and the Price Adjustment Board there demanded an increase in the rebate to $12,500,000. The Detroit negotiations, the company was advised, were to be "entirely ignored." The company then inquired whether this was the "final demand," and if it could be so reported back to the directors. Washington's P.A.B. would simply say that higher boards might want still more.

Whether Timken-Detroit Axle or any other company was making too much or too little money on a war contract is beside the point in such a situation. Obviously, no ground rules apply except the feelings of a member of a Price Adjustment Board, and the way he reacts or does not react to a presentation by a company.

Industry has generally taken the stand that the taxing power should be used to reduce profits, thereby making possible a much more positive and less personalized method of reducing excessive wartime profits than is the case under a system of renegotiations. In this position, however, corporations may be on shaky ground, as was indicated in the hearings by Bernard M. Baruch.

He stated that the disadvantage of such a system was that percentages of net income tend to remain constant regardless of the size of the contracts involved. Industry can, therefore, circumvent the intention of taxes, he pointed out, simply by increasing prices and profits. This position has enough strength that industry may be well advised not to stand against it.

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New Joint Price Adjustment Board To Correlate Renegotiation Methods

Washington

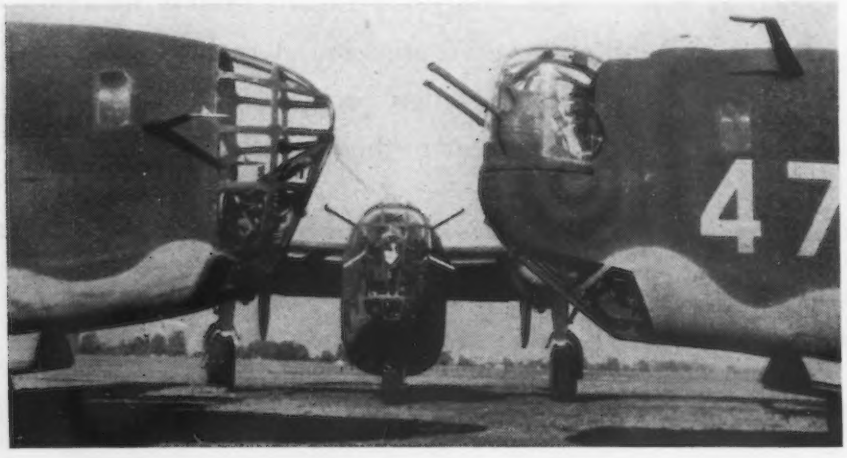
• • • **A Joint Price Adjustment Board** to exercise certain authority now exercised by the individual agencies renegotiating war contracts was announced last week by the War, Navy and Treasury Departments, the Maritime Commission and the Reconstruction Finance Corp. for its subsidiaries subject to the Renegotiation Statute.

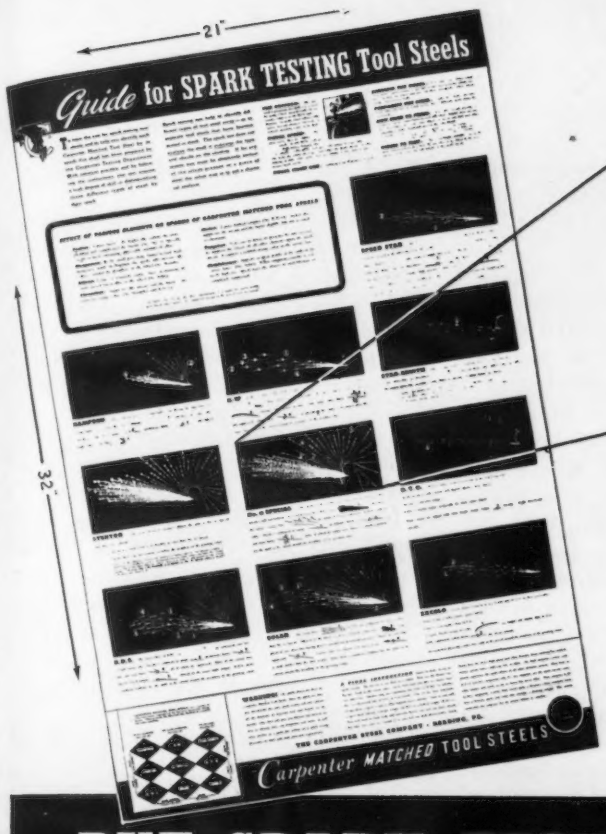
The establishment of the joint board provides a formal procedure in place of the informal procedure which has been followed by the individual price adjustment boards since their establishment and the relationship which has been maintained between them in such matters as the adoption and publication of joint statements of purposes, principles, policies and interpretations.

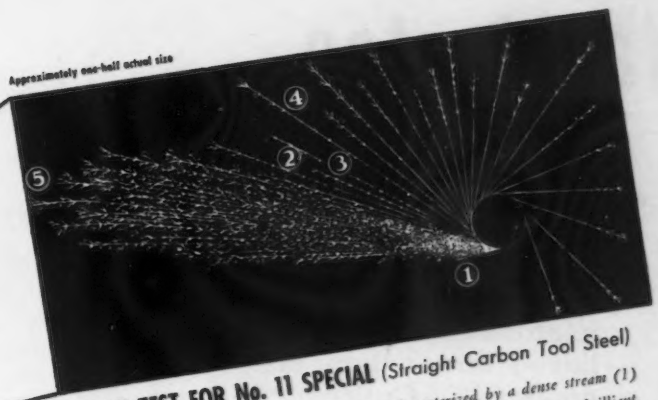
The personnel of the joint board is as follows: Mr. Joseph M. Dodge, chairman of the War Department Price Adjustment Board, chairman; Mr. Kenneth H. Rockey, chairman of the Navy Price Adjustment Board, vice-chairman; Mr. Thomas M. Woodward, chairman of the Maritime Commission Price Adjustment Board, who is also representing the War Shipping Administration Price Adjustment Board; Captain Harry C. Maull, Jr., chairman of the Treasury Department Price Adjustment Board; Mr. Charles T. Fisher, Jr., chairman of the Reconstruction Finance Corp. Price Adjustment Board, and Mr. Carman G. Blough, WPB representative.

The secretary or head of each of the departments or agencies engaged in renegotiating war contracts under the Renegotiation Statute has delegated authority and discretion to the joint board to formulate and adopt statements of purposes, principles, policies, and interpretations; to exempt from some or all of the provisions of the statute general classes or types of contracts, and to formulate standards for the exemption of such contracts; to determine whether any contractor shall be required to renegotiate for any fiscal period; to assign any contractor to any department for determination whether excessive profits have been or are likely to be realized; and to prescribe by joint regulation the form and details of the financial statements contractors may file.

IMPROVES WITH AGE: The production model of the first Ford Liberator (left) had a nose equipped with one machine gun, the next design (center) carried three guns, while the present bomber has the nose completely revamped to handle a power turret.







SPARK TEST FOR No. 11 SPECIAL (Straight Carbon Tool Steel)

This spark stream is full and brilliant. It is characterized by a dense stream (1) adjacent to the wheel. Carrier lines (2) are relatively long, continuous, brilliant, almost white. Stream is composed of sprigs (3), preliminary bursts (4) and main bursts (5)—none of them suppressed. There is a marked tendency for the spark to be carried around the periphery of the wheel.

Put this Useful Spark Testing Guide to Work Today!

PUT SPARK TESTING TO WORK IN YOUR PLANT...

- **to "unscramble" mixed tool steel stocks**
- **to check the identity of tool steel before hardening tools**

If, in spite of all your precautions, stock mix-ups do occur, *Spark Testing* can help you quickly identify an unknown piece of tool steel.

And this method is often used to check the identity of tool steel before tools are hardened. Thus, it helps to insure correct heat treatment on each job.

By simply holding the steel against an emery wheel and watching the colors of the lines and bursts of the spark stream, you get a quick indication of the major elements present. For example, the Carpenter "Guide for Spark Testing Tool Steels" describes the spark patterns caused by major elements such as carbon, tungsten, molybdenum, etc.

This convenient wall chart was prepared by our own testing department, and is designed to assist your men in getting started on *Spark Testing*. It even contains instructions for *Spark Testing* procedure-grinding wheel speeds, etc. With this chart as a guide, the study of *Spark Testing* is greatly simplified and your men can easily become familiar with this method of steel identification.

For your copy of the Carpenter "Guide for Spark Testing Tool Steels", drop us a note on your company letterhead. We'll be glad to give you a copy.

THE CARPENTER STEEL COMPANY
121 W. Bern Street, Reading, Pennsylvania

Carpenter MATCHED TOOL STEELS

Washington . . .

L. W. MOFFETT

• Nelson's visit to Russia may indicate U. S. participation eventually in the rebuilding of the Soviet . . . Value of terminated contracts believed larger than announced . . . Outlook for civilian supplies brighter . . . Other comment analyzed.

WASHINGTON—"It can be assumed that Don Nelson went to see Joe Stalin for something else besides giving him some pipes," a WPB spokesman said recently in confirming rumors that Mr. Nelson went to Europe to lay plans for giving American assistance in that continent's reconstruction.

Talk at WPB among highly placed officials indicates an Administration desire to rebuild factories, streets, bridges, buildings and public utilities. Plans definitely have been laid to use American surpluses in metals, machinery and manufactured goods for this purpose.

Terminal contracts, WPB officials say, are flowing millions of tons of steel and billions of dollars in goods through the services to the WPB regional offices which are charged with redistributing these materials. The Redistribution Division has been told to take a look at the situation and to make recommendations on how much materials and goods can be devoted to rehabilitation and reconstruction.

The Administration's plan to get rid of troublesome war surpluses will call for the usual buzz for Santa Claus, whose junket as usual will be taxpayer-sponsored. However, serious obstacles face the plan which is primarily a State Department chore.

The first is that Congress may violently oppose the "Good Samaritan" giving away of American money and goods to Europe's bankrupt war-torn nations. The second is the growing British opposition to such a move. The Administration plan has considerable support from industry, apprehensive over high inventories and low prices.

A third hurdle will be reluctance on the part of some of the companies to participate in subsidies and the incident continuing control by the government over the steel industry.

BRITAIN, which is dependent upon the export of 40 to 60 per cent of her steel, will naturally resist the invasion of her natural markets. Already, on this score there is reported to be considerable quarreling among members of the rehabilitation groups in London. There is definite disagreement about this among members of the British Leith-Ross Committee, it is said. The Lehman and Harriman groups, which are the American counterparts of the Leith-Ross Committee, are said to have reported this discord.

A WAR Department source says that the value of terminated contracts is now close to $8,000,000,000 instead of the $6,000,000,000 as recently announced by Undersecretary of War Patterson. This same source declares that there will be another $15,000,000,000 to $20,000,000,000 worth cancelled when the European war ends.

WPB Steel Division officials say that excess steel from terminated contracts is mainly in sheets, bars, tool and alloy steels. The structural, plates, pipe and rail needed by Europe will not be available in quantity until the coming of peace. At that time, it is estimated that the holders of terminated contracts will own from 20,000,000 to 30,000,000 tons which is expected to be devoted to this purpose.

Difficulties with rounding up surplus materials and shipping them abroad will be met through the creation of a new agency, it is predicted. The new agency will have a tremendous task inasmuch as no one knows how much property the services own.

AS foreseen by this column early in August, the outlook for civilian supplies is growing brighter. Although the Office of Civilian Requirements is only claiming 225,000 tons of steel from the materials pie in the first quarter of next year which is approximately the same as was gotten for this period, WPB may make available 50,000 tons of excess steel held by the defunct Steel Recovery Corp.

Furthermore, with the end of the war in Europe nearer, WPB officials are conceding that second and third quarter allotments for next year may be generous indeed. Supplies will reach retail channels because of mid-war conversion and relaxation of limitation orders. Ranking officials regard this as a certainty.

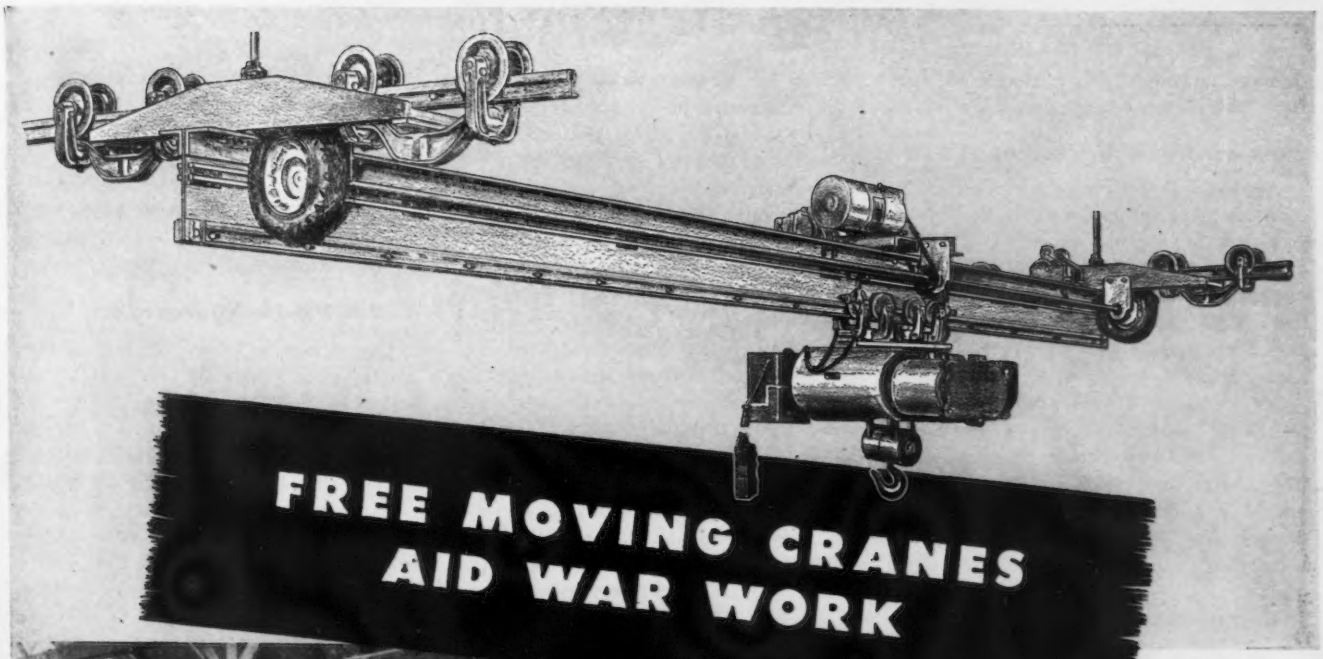
A plan to make Army surpluses available to civilians and at the same time to permit the Army to continue to claim materials and replace the released items in its already swollen warehouses, is said to have been ordered by War Mobilizer James F. Byrnes.

Whether Justice Byrnes ordered this change, the result will be that consumers will soon get many items from stores which have not been procurable since the war began.

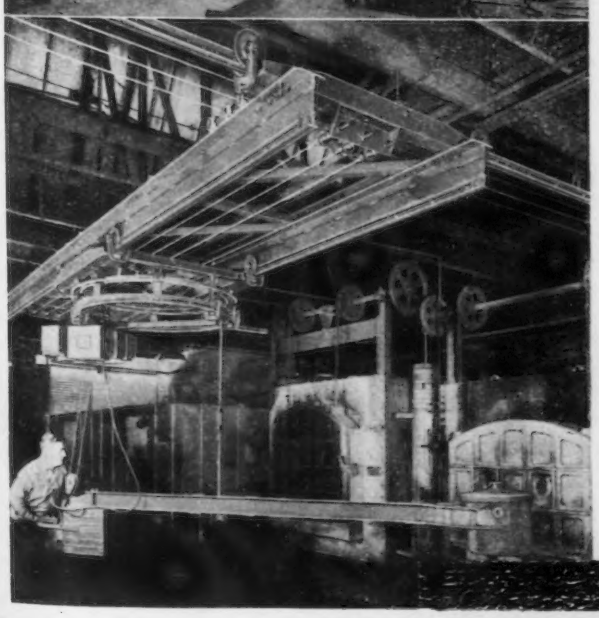
WFA Making Demands

While the Army no longer regards OCR as a serious threat as a claimant for steel supply, the War Food Administration is responsible for many a headache. WFA is making stringent demands for farm machinery and implements, including tinplate for the food pack for 1944. The

NEW CHAIRMAN of the Fair Employment Practices Committee, Malcolm Ross, formerly head of the press section of the National Labor Relations Board, succeeds Msgr. Francis J. Haas who resigned after being named Bishop of Grand Rapids, Mich.



FREE MOVING CRANES AID WAR WORK



Flexible Design Permits later adaptability to regular production

Every American MonoRail System must be "made to order" and yet, these "tailor-made" systems are made from standard parts. Because of its extreme flexibility, American MonoRail offers a wide range of application without costly adjustment or lengthy engineering.

American MonoRail Cranes have proved to be invaluable in hundreds of installations. With the structural design greatly simplified, dead weight of the crane bridge is kept at the lowest point consistent with strength. This provides maximum live load capacity and requires less effort to move. Elimination of friction at all points by the scientific use of proper bearings make American MonoRail cranes the easiest of all to handle.

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SEND FOR BULLETIN C-1. A 56 page book showing successful applications of American MonoRail Systems

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THE AMERICAN MONORAIL CO.

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demand supposedly is higher item for item than ever made before.

Data on Ingot Movement

About 25,000 tons of excess ingots monthly are being moved by the Steel Division to companies whose rolling capacity exceeds their steelmaking capacity, except for the tightness in flat rolled capacity. Most of the excess ingots are from Carnegie-Illinois and Republic.

At WPB it is said that the problem of finding rolling orders for ingots that were being banked has been solved. Hence the board discounts reports that any open hearth furnaces will have to be closed down because of excess ingots. Giving emphasis to this position is the loss of steel production in the South due to the coal strike.

Carbon Steel Output Boosted

Actually, it was pointed out, carbon steel production in the open hearth furnace definitely has been stepped up as a result of transferring alloy tonnage from the open hearth to the electric furnace.

WPB says that while electric furnace melting capacity at the beginning of October exceeded demands by about 40,000 ingot tons or approximately 25,000 product tons there is no excess of electric furnace production. The problem has been solved, it is claimed, due to the great need for carbon steel, which was increased in the open hearth by diverting alloy tonnage to the electric furnace.

All electric furnaces will operate throughout October. As the result of increased production of carbon steel in the open hearth through diversion of alloy material to the electric furnace, it was said that certain carbon tonnages that were promised for delivery in January and February were cared for in October.

Army to Judge Inventories

The form new termination legislation may take is being predicted by every department concerned with the problem. The most likely-to-be-adopted draft which has not yet been proposed is a law which will make the determinations of Army and other procurement agencies absolute in the field of estimating the value of inventories. The General Accounting Office would then be given authority to review other accounting questions.

Will WPB Be Squeezed?

The designation of a unit within OWM to set policy on contract termination and other financial matters connected with demobilization promises to squeeze WPB out of the field entirely. Top WPB officials are awaiting the return of Mr. Nelson to see if he can rescue some authority from OWM. Mr. Nelson may have more Congressional backing in this project.

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Reconversion "Bugaboo" Deflated

Buffalo

• • • **Lawrence S. Hamaker** of Cleveland, assistant sales manager of Republic Steel Corp., declared in an address here that the problem of reconverting plants after the war will not be the "bugaboo" it is feared in some quarters. He said probably not more than 20 per cent of American industry would have to make any substantial changeovers.

"There probably has been too much alarm on this subject," said Hamaker. "The steel industry, for instance, could change over to peacetime production this afternoon."

The big problem will be the money plants have invested in inventories of war materials.

"Unless some arrangements are made for the government to free these funds at the end of the war, quite a few of the smaller companies, at least, are going to go broke."

Hamaker predicted a "tremendous" increase in export demand for steel after the war, with European producers unable to meet the needs for rebuilding torn cities and industries for several years.

"It is fairly apparent two-thirds of the German steel industry is being deliberately and systematically destroyed," he said, "not only to bring her to her knees but to eliminate any possibility of rearming after the war. It is interesting to note the French, Belgian and Czech steel industries have been spared although they are producing for the enemy. The Japanese steel industry, as well as her other heavy industries, is scheduled for the same fate as the Germans."

Russia, while nearly self-sufficient, likely will have to import steel for rebuilding her cities and industries, he added.

Hamaker said the Buffalo area steel industry probably would operate at a higher rate after the war than the nation's steel industry as a whole, in which he expects a moderate letdown. The Buffalo Republic plant, he disclosed, has been supplying an important volume of steel to Canada.

THE BULL OF THE WOODS — BY J. R. WILLIAMS

NEW THREAD-GRINDING ECONOMY ON COMMERCIAL PRODUCTION

Greatly increased production of thread grinding which produces a far more accurate and precise thread of superior finish than possible with other methods, may be achieved with Sheffield Precision Thread Grinders. These are the first American designed machines on which either the multi-ribbed or single-ribbed wheel may be used.

The finished thread may be formed in one plunge cut with the multi-ribbed wheel—high production of high quality. Multiple threads are ground in one pass without necessity for precision indexing.

Fine threads can be ground AFTER hardening, especially on thin-walled components, eliminating objectionable stresses and possibility of distortion—also assures thread being held concentric with other ground diameters and threaded sections of work part.

Substantial savings in operating time over conventional machines make it more economical to grind threads with a Sheffield Thread Grinder. Also because of these savings, it is now feasible to grind threads formerly produced by other methods.

WRITE FOR FULL DETAILS • BULLETIN M-100-143

SHEFFIELD MASTER CRAFTSMEN

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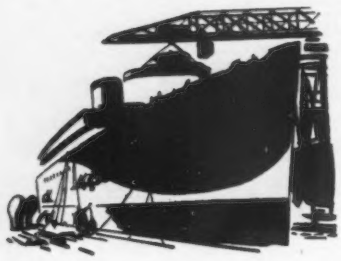
Dayton 1, Ohio, U.S.A.

ARMY E NAVY

MACHINE TOOLS—GAGES—MEASURING INSTRUMENTS—CONTRACT SERVICES

WEST COAST . . . OSGOOD MURDOCK

• Airframe makers, becoming inventory conscious . . . Find they need more salesmanship and less priority restrictions as they start to move huge surplus inventories of tools and materials . . . Cast iron scrap restrictions intensify shortage.



SAN FRANCISCO—That principal southern California airframe manufacturers are beginning to be inventory conscious is apparent from voluntary action during the past two months by two major companies to dispose of extensive surplus materials, supplies and machine tools. Approximate value of the surplus inventory of one of these companies ran into eight figures. The second big company now successfully disposing of its idle surplus inventory issued a well prepared catalog over an inch thick for the use of its accommodation sales representative in the material control department. In addition to considerable quantities of semi-finished steel materials, there were greater quantities of odd lot aluminum. Among supplies it was not infrequent to find as many as 10,000 dozen of one size drill and corresponding quantities of milling cutters, some of them standard and staple, but some especially for aluminum and aircraft production.

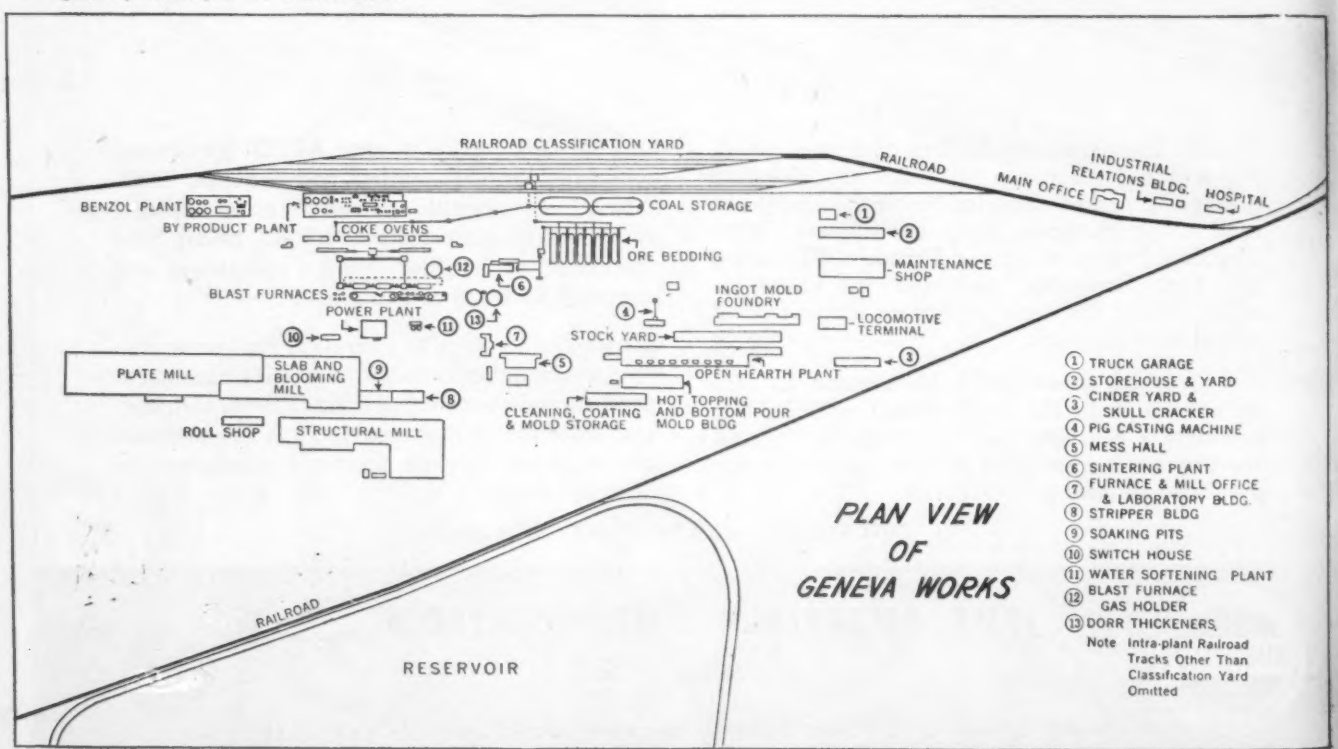
Hitherto, all procurement, redistribution and surplus inventory control in the aircraft industry has been in the powerful hands of the Aircraft Scheduling Unit.

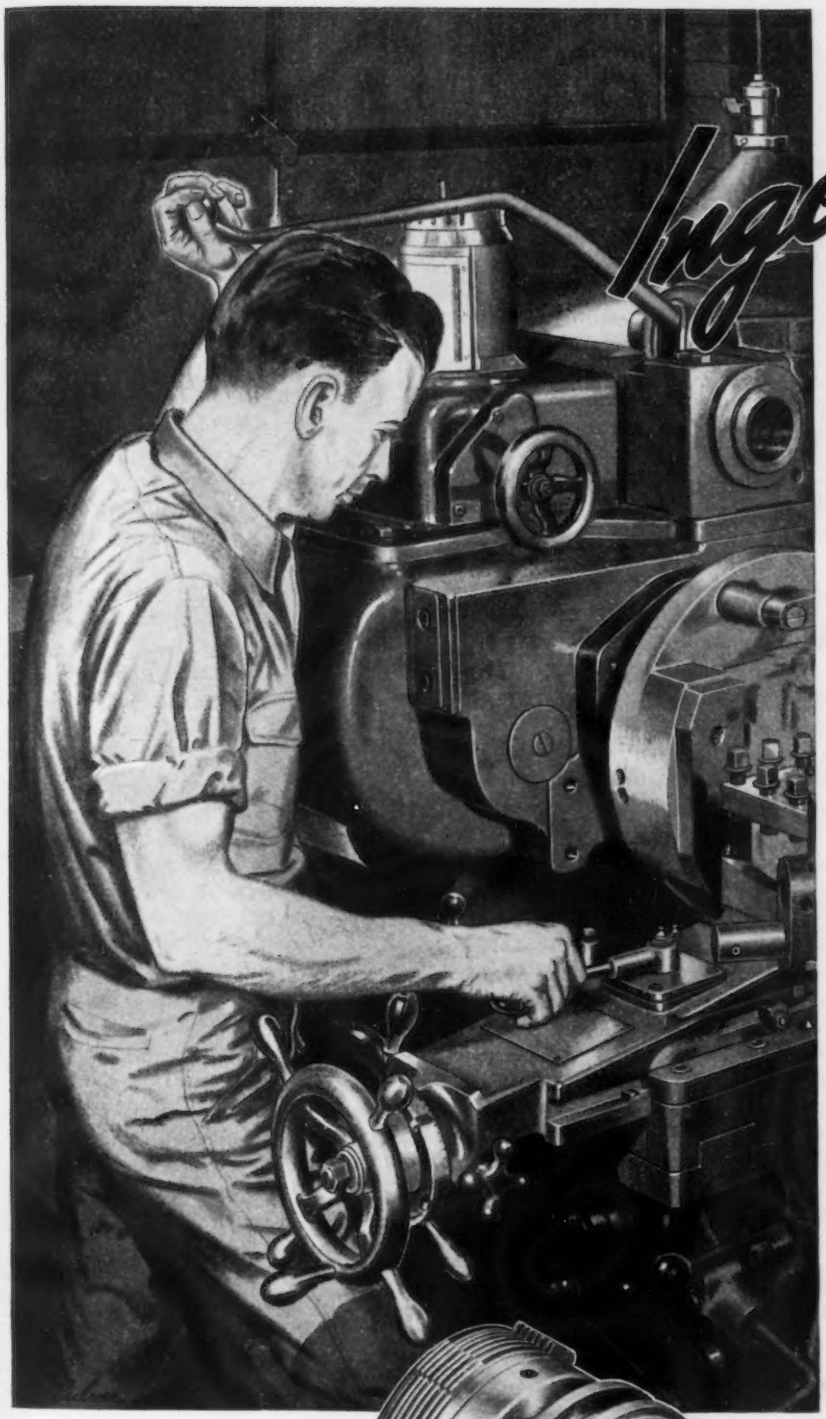
Under ASU's authority the Aircraft War Production Council of the principal airframe manufacturers has facilitated the exchange of materials, supplies and surplus equipment within the aircraft industry. Official directives still technically prevent any interference or check up by Salvage, Redistribution or other WPB inventory control agencies under whose scrutiny production outside of aircraft is conducted.

Although a $10,000,000 surplus inventory from a single company cannot be considered a trickle, nevertheless it is manifest that this first voluntary liquidation of surplus materials, requiring even initially considerable sales effort by only two companies, is just a prologue and hint to the avalanche that will follow. Three other major Grade-A Pacific Coast airframe producers are reported so busy with current contracts and production problems, or so fearless of being caught on a future cancellation day with more than a 60-day inventory on hand that they have not yet gotten around to liquidation.

Careful procedure is involved, for all materials are critical and require painstaking pricing to keep within OPA ceilings and high ratings within WPB restrictions. There has been difficulty in moving even these initial stocks, because of their size and special character, and there is some feeling that greater leeway should be allowed on ratings and WPB restrictions. The entire southern California industrial area, and all Navy estab-

NEW STEEL PLANT FULLY INTEGRATED: Features of the new Geneva Works, built for the government by Columbia Steel Co. at a cost of about $180,000,000, include its transportation layout, the methods used to insure adequate water and the system for handling iron ore. Diagram by courtesy of U. S. Steel News.





Ingenuity's Children

By now it's quite obvious that the world has entered upon the greatest production period in history. The demands of these times could never be met without machine tools. Those products of fertile, ingenious brains made possible the kind of production which places so much within easy reach of so many of us.

Today most leading machine tool builders entrust to Twin Disc Clutches the important function of linking driving and driven units of their machines. In this field, as in many others, the quarter century which the Twin Disc Clutch Company has devoted exclusively to industrial clutch design and manufacture has had far-reaching results. It has helped make possible more widespread distribution of the countless time and labor-saving articles in whose production machine tools play such a vital role.

As quickly as new techniques were developed and machine tool work cycles were speeded up, clutch problems became more complex. These special problems, together with those of other industries depending on power links for operation of essential machinery, have found most satisfactory solution in the stamina, dependability and efficiency which Twin Disc Clutches bring to the wide variety of work they do.

Builders or buyers of industrial equipment can get intelligent help on power linkage problems from Twin Disc engineers because we build both friction clutches *and* hydraulic drives. A wealth of factual data and engineering experience covering both types is here at your disposal. Just write and ask for the information you need. TWIN DISC CLUTCH COMPANY, Racine, Wisconsin.

Twin Disc Machine Tool Clutches add easy operation and single point adjustment to compactness, high torque capacity and long wear life to stay ahead of every demand made of them by modern high speed production.

lishments on the Pacific Coast and all others with high ratings cannot immediately absorb the surplus inventory of only one major airframe manufacturer. So there seems no valid reason for considering these materials so scarce as to require current strict rating protection. When four other Grade-A airframe producers, the half dozen Grade-B, the Navy, Maritime Commission and the various Army procurement agencies all get around to sluffing off their surplus stocks, it is already evident that salesmanship, subsidies and inducements rather than restraints and priority ratings will be necessary.

HOW to increase available supplies of cast iron scrap on the West Coast has become a major problem. Foundry buyers and scrap processors are earnestly urging OPA to permit a mixed car provision so that segregated quantities of various grades of scrap may be shipped in the same car, each priced separately. A preparation in transit allowance is also suggested, to permit freight and an efficient preparation charge in the scrap dealer's yard to be added to the original shipping point price on which ceilings for various delivered grades are based. There is also urgent recommendation that the present $2.50 a ton preparation charge be increased by $1.00. All these constructive suggestions are understood to be approved by far western regional officials of OPA, and probably all will be eventually begrudgingly granted, though apparently more horses must escape before these barn doors are locked.

By recent directive, sale of cast iron scrap to open hearth furnace consumers has been stopped except by explicit permission of WPB.

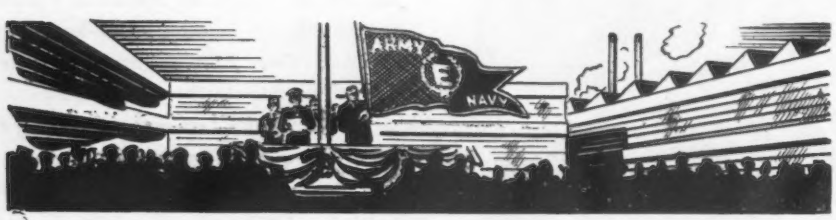
WHEN the preparation charge for open hearth steel scrap was recently increased from $2.50 to $3.50, without raising the ceiling, the price of all unprepared scrap was automatically reduced $1.00. Thus the schedule now permits a cushy $6.00 per ton preparation charge for electric furnace grades under 12-in. In these days of toil and turmoil for scrap processors, this has been manna, with the result that everyone wants to prepare shipyard scrap and sell electric furnace grade. From 35,000 to 50,000 tons of shipyard scrap are available per month on the West Coast. It's clean, high-grade scrap, predominantly plate, and quite a sizeable quantity is already under 12 in. Acquisition of simple shears, modest yard and transit facilities and the right connection with the shipyards has established several new processors specializing on electric furnace grades from shipyard scrap.

Because the Kaiser Fontana blast furnace continues to require 25,000 tons of scrap per month, contrary to original expectations and plans, until more plate production and consequent home scrap more nearly balances the plant, it has been necessary to ship scrap by rail in sizable quantities from as far away as Portland, Oregon, 1200 miles distant. Southern California, contrary to its historic condition hitherto, is a consistently minus scrap area these days.

In southern California, although few war contracts have been cancelled, from 10 to 25 cases a month occur wherein no renewal or additional contract is placed. Instead of the indefinite backlogs of six months ago in shipbuilding, only five of the 23 South Coast shipbuilding firms are reported to have present contracts to carry them through 1944. Only half of the firms have future business for more than six months. Firms in the five and low six figure brackets are the ones that complain and seem to suffer from these terminations of Maritime Commission, Navy and various Army procurement agency requirements.

Wayne L. Morse, earnest and aggressive representative of the public on the National War Labor Board and the former dean of the law school at the University of Oregon, has been prominently mentioned and locally recommended for consideration for a Federal judgeship in the Pacific Northwest. . . . A steel bridge across the Yellowstone River near Fallon, Montana, on which bids are opening at Helena Oct. 25 will require 1300 tons of steel, principally structural.

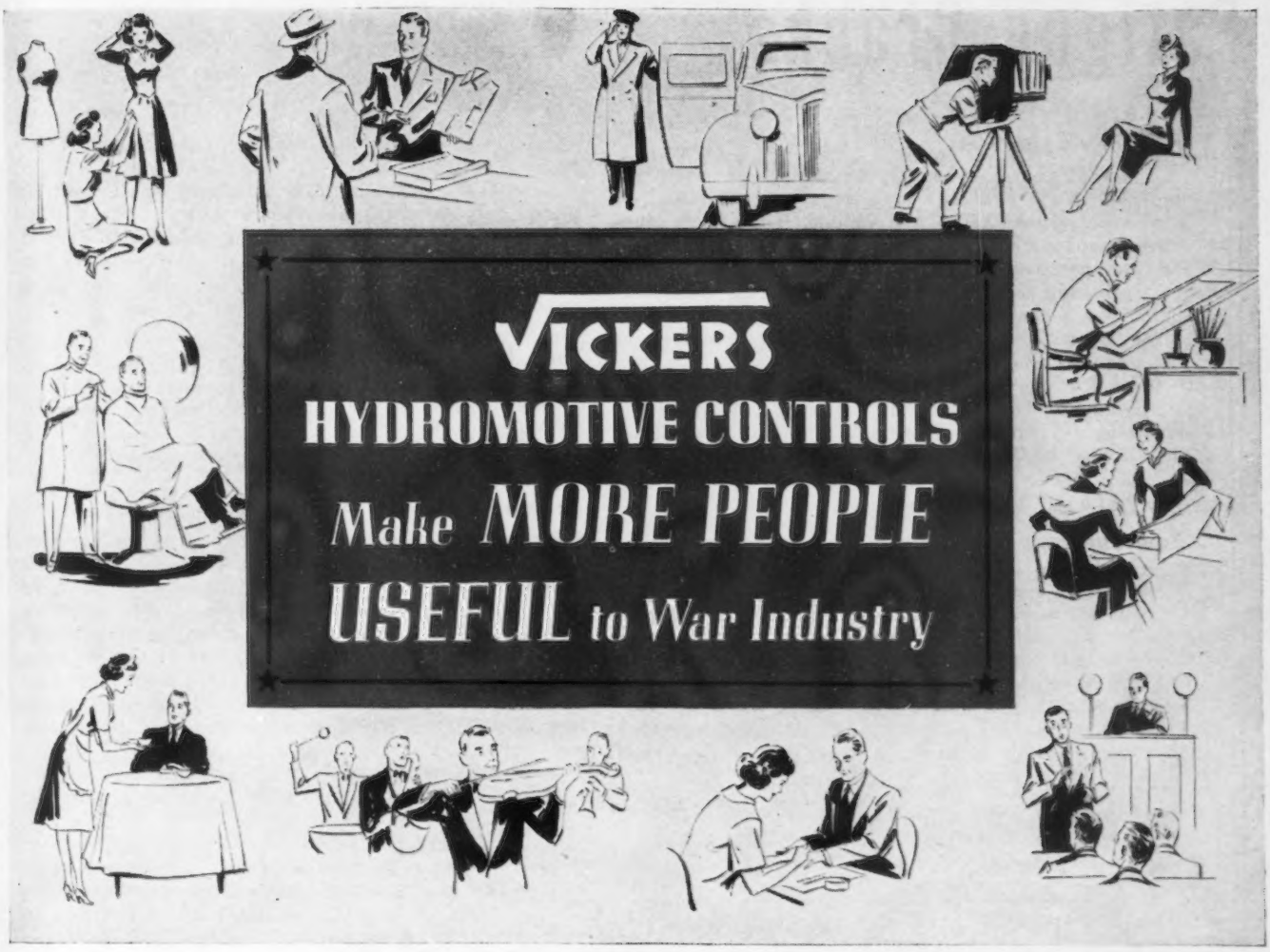
The following management panel has been set up by Paul R. Porter, chairman of the WPB stabilization committee to "speed up the handling of labor management problems in Pacific Coast Shipyards: Lawrence C. Rogers, Commercial Iron Works, Portland, Chairman, Clare Bowman, Seattle-Tacoma Shipbuilding Co., J. O. Murray, Portland Kaiser Yard, A. G. Gaffney, General Engineering Corp., San Francisco, Russell Bergeman, California Shipbuilding Corp., James Eagan, Richmond. . . . Labor unity and solidarity are evidenced in a joint petition by AFL, CIO and independent union aircraft workers of southern California seeking increase of hourly pay rates to a minimum of 80c. an hour. . . . Stockholders of the Los Angeles Shipbuilding & Drydock Corp. rejected by a three to one vote the recent offer of Consolidated Steel Corp. to purchase the company's yard. . . . Production of Army CD-4A plywood transport gliders by Timm Aircraft Corp. of Los Angeles was reported increased 27 per cent for August over the previous month. Area manpower authorities for California are preparing to announce ceiling limits on the number of employees of all essential war industries employing over 50 as of certain past date to be determined. No employer may then exceed ceiling, also 10 per cent of men are to be replaced by women gradually as individual men separate.



. . . Cited for Awards . . .

• • • **The following companies** have been awarded the Army-Navy "E" award for excellence in production of war equipment.

Westinghouse Electric & Mfg. plants at East Pittsburgh, Trafford, Derry and Nuttall, Pa.; Transformer Div., Sharon, Pa.; Steam Div., South Philadelphia; Philadelphia Mfg. & Repair Div.; Newark, N. J., Mfg. & Repair Div. (renewal stars)
Westinghouse Electric Elevator Co., Jersey City, N. J. (fourth renewal star)
Farrel-Birmingham Co., Inc., plants at Ansonia and Derby, Conn., and Buffalo (third renewal stars)
Wheeling Corrugating Co., Wheeling, W. Va.
Heller Brothers Co., Newcomerstown, Ohio, plant
Auto-Lite Battery Corp., Metal Mfg. Div., Long Island City, N. Y.
Dayton Tool & Engineering Co., Dayton, Ohio
Foote Co., Inc., Nunda, N. Y.
General Motors Corp., Packard Electrical Div., Plant No. 4, Warren, Ohio
McElroy Mfg. Co., Boston Plant, Boston
Mount Hope Finishing Co., North Dighton, Mass.
Parkwood Corp., Wakefield, Mass.
Rawlings Mfg. Co., St. Louis
Reed & Prince Mfg. Co., Worcester
Savage Tool Co., Savage, Minn.
St. Joseph Lead Co. of Pennsylvania, Josephtown Smelter, Josephtown, Pa.
William E. Wright & Sons Co., West Warren, Mass.



Lawyers—manicurists—barbers—waiters—salesmen—housewives—all sorts of people must be used by industry to meet the critical manpower shortage. These people are usually entirely unfamiliar with machines and shops. Before they are useful in production, their sense of strangeness and their lack of self confidence must be overcome . . . and they must be taught to run a machine.

A complex machine makes the training task extremely difficult. It is much easier with machines equipped with Vickers Hydromotive Controls.

When one of these people is shown a Vickers controlled machine—shown how simple the controls are—how easy it is to produce good work, his strangeness and lack of self confidence are quickly overcome. It becomes much easier to train him to useful production needs.

With Vickers Hydromotive Controls, most of the required skill can be built into the machine. Complex operations can be reduced to simple routines or made automatic. Controls can be interlocked so it is impossible to do the job wrong. Exact load limitations are easily applied.

Discuss "hydraulics" for your machines with a Vickers Application Engineer.

VICKERS *Incorporated* • **1420 OAKMAN BLVD.** • **DETROIT 32, MICHIGAN**

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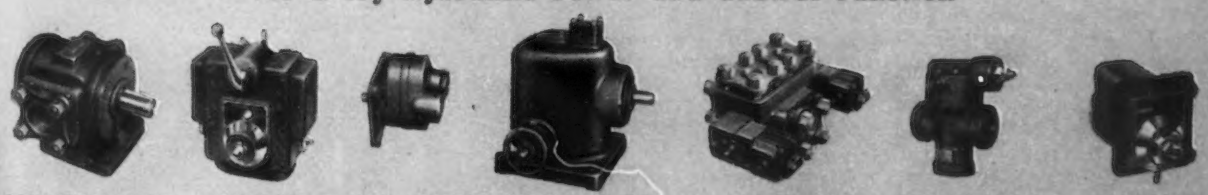
CHICAGO • CLEVELAND • DETROIT • LOS ANGELES • NEWARK • PHILADELPHIA • ROCKFORD • TULSA • WORCESTER

Representative of More than 5,000 Standardized Vickers Units for Every Hydraulic Power and Control Function



CONSTANT DELIVERY PUMPS | CONTROL ASSEMBLIES | FLUID MOTORS | VARIABLE DELIVERY PUMPS | DIRECTIONAL CONTROLS | PRESSURE CONTROLS | VOLUME CONTROLS

Fatigue Cracks . . .

BY A. H. DIX

Mother's Knee Wins

A recent visitor asked for an article we published in 1940. No copies were left so we let him read it in our Jan.-June 1940 bound volume. The article must have meant much to him. As we reconstruct the scene, he was assailed by a temptation to clip the article furtively and slip it into his pocket. This was combatted by a feeling against destroying other people's property, probably implanted in early childhood on his mother's knee.

Mother's knee won, so he walked off with the entire volume. This leaves us with the job of reconstructing a substitute. Here and there we have picked up all but the Mar. 21 and Apr. 4, 1940 issues. We would give five years of our life to any loving reader who could fill in these gaps.

Paul Bunyan's O.H.

One heat from a single large open hearth would supply most of the steel necessary to produce all the wire rope which will be sold this year . . . more than 200,000 tons.

—*Page 103, Oct. 7* IRON AGE

We usually come in second-best when we tangle with the brains department, so even though a large open hearth heat runs from 200 to 225 tons, the above sentence is not quoted critically. We merely suggested that the qualifier be changed from "large" to "very large."

Aptronyms

Bishop B. Kirkbride is general manager of the B. B. Kirkbride Bible Co., Indianapolis.

—*W. A. Groat, Jr., Indiana Gear Works, Indianapolis 7, Ind.*

And the treasurer of the Merchant Tailors and Designers Assn. is J. Press.

Senator Hits Jackpot

Until Senator Pat McCarran spoke up, we had not been able to work up a sweat about any of the plans for preventing large-scale postwar unemployment. The Senator has, it seems to us, hit the jackpot. He proposes, as you know, that every state be provided with steel-producing capacity, government financed.

Here is the penicillin that will slay the dreaded bacteria of mass unemployment. Before you object that unemployment will be created in the steel-producing states, bear in mind that making each state self-sufficient in steel is just the beginning. Labor released from the steel mills of Ohio and Pennsylvania will be put to work erecting huge greenhouses for growing cotton and oranges. The Senator's own home state, Nevada, now produces the bulk of the silver. But as almost all soil contains a trace of silver, each state can have its own silver-extraction plant.

And is it fair that the blessings of low-cost hydroelectric power be enjoyed by only a few states? Why not a huge, elevated lake in Indiana, with the Wabash being pumped uphill at government expense, so that as it tumbled downhill again it can provide the Hoosiers with low-cost power?

We see Rhode Island with its own cattle ranges and Wyoming with its own tobacco plantations. Not only will there be jobs for all, but the labor shortage will be so acute that again, as in the '90s we shall have to scour the labor markets of the world again as we did in the '80s and '90s. The Senator has smashed the economic atom.

On Which There Can Be No Possible Doubt . . .

• • • Fun is poked at Calvin Coolidge's shade for uttering the truism that when a lot of people are out of work unemployment results. The criticism overlooks the sound sense in beginning an argument with a statement so obvious that the mind of the listener can grasp it without strain.

Even Walter Lippmann is not above starting off his heavy duty cerebral excursions with a hurdle that barely reaches the instep. During the sadder part of the Hoover regime he said, "If we had recovery, we should have no serious problem of relief," which is merely a reverse print of what Coolidge said.

They Left Out An "S"

If the absence of an "s" where one is expected gives Deac a headache, keep him out of Two Rock, Sonoma County, Calif.

—*Jos. S. Thompson, President, Pacific Electric Mfg. Corp., San Francisco, Cal.*

England Coins An Americanism

• • • We see by the papers that Germany's only chance of winning now lies in the possible success of her efforts to get the Allies to squabble among themselves. She has already had some slight success in this direction, which is only to be expected considering that annoyance over the body odor of the fellow at the next oar may momentarily outweigh fear of having the boat sunk by a shot from the enemy. The pimple on the nose of a nearby friend looms larger than the cancer in the soul of a distant enemy.

Among the major distresses mentioned by a sailor who was 81 days adrift on a raft was the presence of a Mississippian who persisted in saying "that-away."

In the face of our common danger we will forgive the English for calling an engraver's proof an "artist's pull." This is something that can be settled after the war. Meanwhile, as our contribution to harmony, we will expose these words sent us by I.A.J. Duff, an English member of this page's loyal army of eighteen readers:

We've got quite a few of your lads over here now, and the more I see of them the more I like them. Pity you didn't send your army over prewar, instead of what we got. However, I suppose trippers have the same manners whether English, American, German or what will you (see Mark Twain), and you can probably tell me one or two things about what we sent you to balance any account.

Your chaps have settled in and in spite of what one or two xenophobes have said, we like them. In fact we ignore them—treat them as part of the country scenery —which in England anyway is the biggest compliment you can pay anybody.

We could toss a similar bouquet at Mr. Duff, for his uniformed countrymen here fit gracefully into the American scene. Our only complaint lies in something we heard the other night on a quiz program. An Englishwoman said, "As you Americans say, 'Let's get cracking.'" The American announcer said he had never heard of it and asked what it means. "Why," said the Englishwoman in astonishment, "in your country it means 'Let's get started.'" We never heard of it either.

Sartorial Note

This is as good a time as any to enter in the colorful phrase contest of 1943 the following, from a letter Ickes recently wrote to a certain state executive:

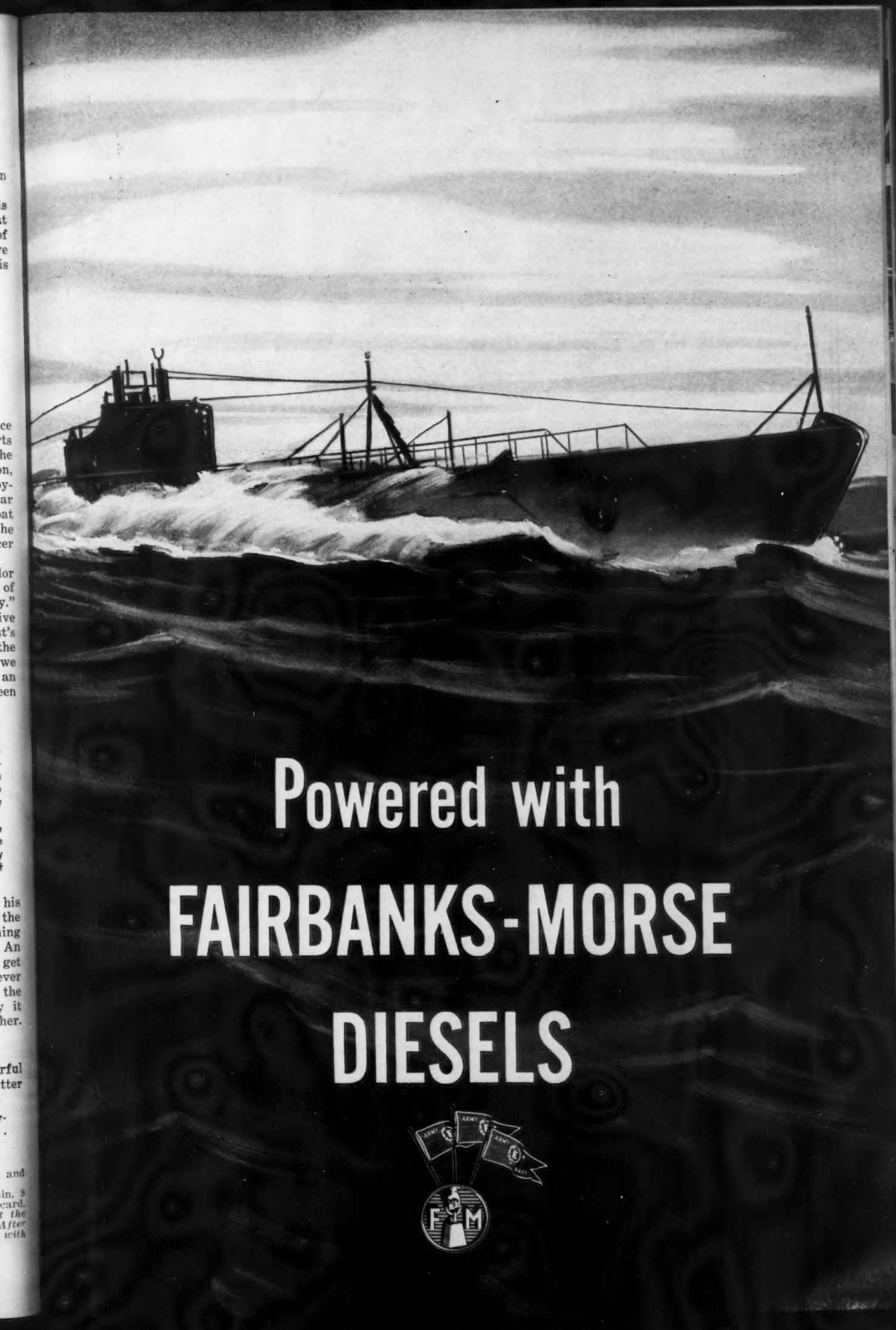
As you go vociferously forth, draped in the outer garments of patriotism and the underwear of self-interest . . .

Puzzles

Last week's A, B, and C had respectively $45, $37.50, and $22.50.

Our test staff's score on the following averaged 2 min. 9 sec. If you beat that paste a gold star on your report card.

Three men play a game with the understanding that the loser is to double the money of each of the other two. After three games each has lost just once and each ends up with $24. With how much did each start?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Dear Editor:

GOLD-INDIUM ALLOYS

Sir:

Your Sept. 2 article on gold-indium alloys interests us very much. Can you furnish us more detailed information on the diffusion plating technique used to secure the hard coatings mentioned?

L. E. KRAFFT,
Machine Design Dept.
Apex Machine Co., Inc.,
840 North State Street,
Elgin, Ill.

● For further information, get in touch with the Indium Corp., 60 East 42nd St., New York.—Ed.

BOOKS ON PLASTICS

Sir:

Where can I secure information on plastics? Are there any magazines on the subject?

CPL. MURRAY M. PACHMAN
Med. Det. Sta. Hosp.,
Camp Mackall, N. C.

● Best known magazine in the plastic field is "Modern Plastics," 122 E. 42nd St., New York 17. Among the many books on the subject are the "Handbook of Plastics," by Herbert Simonds, D. Van Nostrand Co., Inc., 250 Fourth Ave., New York, $10, and "Plastics and Engineering," by J. Delmonte, Penton Publishing Co., Penton Bldg., Cleveland.—Ed.

SURPLUS MACHINE TOOLS

Sir:

On page 101 of your Sept. 16 issue you mention that the Ordnance Department has some 10,000 machine tools available for transfer to war contractors.

Apparently the Chief of Ordnance advertises a list of such tools. Please tell us where to write for the list?

E. A. GROBET
Grobet File Co. of America,
421 Canal Street,
New York 13

● For information on the redistribution of machine tools see page 110 of the Oct. 21 issue.—Ed.

ELECTROPLATING NON-METALS

Sir:

Your Aug. 12 "News Front" mentions a process by which plastics, glass, or any non-conductor may be plated. The same page refers to the production of several utility gas-operated machines which will selectively harden large caliber cartridge cases at a clip of one every 10 seconds.

Will you tell us where we can get information on these processes.

A. A. ULLMAN
Servel, Inc.,
Evansville 20, Ind.

● The first process was developed by the Precision Paper Tube Co., 2023 W. Charleston St., Chicago 47. For information on how to plate metals on non-metals, see the two-part article in The Iron Age issues of June 12 and June 19, 1941. Gas-operated machines for hardening cartridge cases are made by the Selas Co., Erie Ave. and D St., Philadelphia.—Ed.

FOREMAN CARTOON

Sir:

Your April 15 issue, page 83, contained a very interesting cartoon, "Action on the Home Front," by Fitzgerald. The cartoon is centered around the Foreman. We would like permission to reproduce this in our plant publication. It is very humorous, and our employees will get quite a kick from it.

J. E. BERNO,
Editor Canton Westinghouse News
Westinghouse Elec. & Mfg. Co.,
Rafe Road, S.W.,
Canton, Ohio

● Granted.—Ed.

MECHANICAL INGOTING

Sir:

Your Aug. 12 issue has an article entitled "Mechanical Ingoting of Aluminum and Magnesium Turnings." We would appreciate it if you would let us know how we may contact the author, Mr. Max Stern.

ALVIN M. BRADLEY,
Production Mgr. Alum. Div.
Sonken-Galamba Corp.,
Riverview at 2nd St.,
Kansas City 18, Kans.

● Max Stern's address is c/o Loma Machine Mfg. Co., 55 West 42nd St., New York.—Ed.

WALL THICKNESS TESTER

Sir:

Your Sept. 30 issue has a short article entitled "Testing Wall Thicknesses of Intricate Castings," page 58. The article refers to the British publication, "Engineering." Will you kindly let us know how we can get this article.

E. L. ALLEN,
Plant Engineer
Pacific States Cast Iron Pipe Co.,
Provo, Utah

● The original article appeared in the British Journal of Engineering for May. The Engineering Library, 29 W. 39th St., New York, maintains comprehensive files of domestic and foreign technical journals and supplies photostats at nominal cost.—Ed.

ANNEALING

Sir:

The series of five articles, "The Annealing of Steel," by Mr. Payson of Crucible Steel Co. of America, has been of particular interest to us, and we would like to know if any reprints are available.

M. L. FREY,
Metallurgist
Packard Motor Car Co.,
1580 E. Grand Blvd.,
Detroit 32

● Crucible Steel Co. of America, 405 Lexington Ave., New York, has made reprints. Inquiries should be sent direct to that company.—Ed.

FORGING FLOW CHART

Sir:

We are particularly interested in the flow sheet, showing time cycle for procurement of typical aircraft alloy steel drop forgings, as shown on page 89 of your Sept. 23 issue. Is it possible to obtain 25 copies?

J. D. ZAISER,
Asst. Gen. Mgr.
Ampco Metal, Inc.,
1745 S. 38th St.,
Milwaukee

● Reprints were not made, but we managed to get six clippings from office copies, and are sending them to you.—Ed.

BRAZING

Sir:

Will you kindly send us copies of the articles on brazing which appeared in your October and November 1938 issues.

O. T. ERICSON,
Chief Engineer
Hannifin Mfg. Co.,
621 S. Kolmar Ave.,
Chicago

● Copies are no longer available. However, all the articles in this series by Dr. H. M. Webber were reproduced by General Electric Co. in a 50-page booklet entitled, "How and Where to Use Electric-Furnace Brazing." The booklet is numbered GEA-3193, and copies may still be available. Write to General Electric Co., Schenectady, N. Y.—Ed.

METAL-WOOD BONDING

Sir:

Your issue of Aug. 19, page 52, referred to a certain new process for metal-wood bonding developed by someone in Great Britain, known as the "Redux" process. Please tell us with whom we could communicate concerning this process.

MATT FINGER
Synvar Corp.,
Wilmington, Del.

● Additional information may be obtained by writing to Aero Research, Ltd., Duxford, Cambridge, England. Similar American products are being manufactured by the following: U. S. Stoneware Co., Akron, Ohio; E. I. duPont Corp., Wilmington, Del.; Goodrich Rubber Co., Akron, Ohio.—Ed.

ELECTROPLATING WITH SILVER

Sir:

The Oct. 14 "News Front" page contains an item pertaining to phosphate coating of steel prior to electroplating with silver. Inasmuch as we are extensive users of silver on steel, we would appreciate additional information regarding this process.

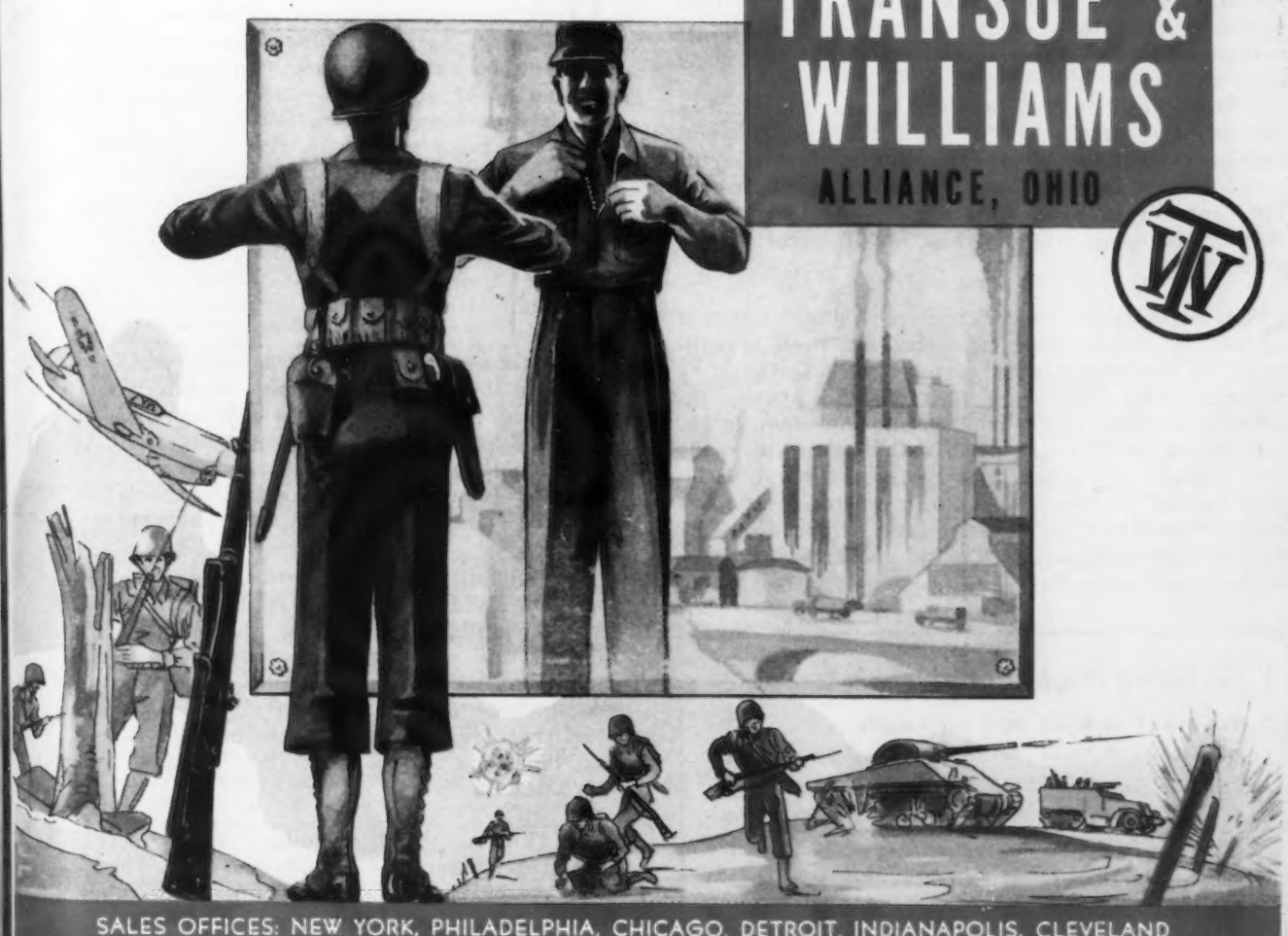
E. W. HARWICK
Diamond Silver Co.,
Lambertville, N. J.

● Write to the Electro-Chemical Society, Columbia University, New York.—Ed.

WHEN the last gun has fired, the conversion from war work to peace-time stampings will be simple at Transue—change dies and obtain the right steel sheets. Production and engineering experience gained these last few years will be valuable in planning and making deep drawn steel stampings for much-needed civilian products.

Designers and Makers of Deep Drawn Stampings

TRANSUE & WILLIAMS
ALLIANCE, OHIO



SALES OFFICES: NEW YORK, PHILADELPHIA, CHICAGO, DETROIT, INDIANAPOLIS, CLEVELAND

This Industrial Week . . .

- ***Easier Trend in Steel Continues***
- ***Coal Strike Outlook Not Optimistic***
- ***Canmakers, Railroads, Others Aided***
- ***Ingot Output Steady at 99.5 Per Cent***

THE trend toward an easier situation in steel still is in progress, with production of finished material achieving fair gains against order backlogs in several products. Undeniably, output is in much better balance with demand and unless sudden changes are forced by the war, the trend will continue, assisted by the advent of new capacity.

National steel ingot production this week is estimated at 99.5 per cent, unchanged from last week's revised rate of 99.5 per cent. There was no optimism early this week in the steel industry over the possibility of a settlement in the outlaw coal strike question. While some of the striking miners in the South had returned to work by Tuesday of this week, new outlaw walkouts occurred in other areas, affecting a total of eight states. The big Vesta mine of Jones & Laughlin Steel Corp. near California, Pa., was the scene of one of the latest stoppages. At least two major steel companies in the Pittsburgh district were reported to have only a few days' supply of coal ahead of their by-product coke ovens. Eight blast furnaces and six open hearths were idle in the South early this week.

Steel mills making plates, sheets and quality carbon bars remain heavily loaded at the moment. Producers confidently expect relief by first quarter through new facilities and the shifting of orders. The transfer of open hearth alloy steel orders to electric furnaces already has aided carbon steel production.

SHIPBUILDING contracts are being watched closely by the steel industry for their significance in connection with plate requirements. It is reported from California that instead of the indefinite backlogs of six months ago in shipbuilding, only five of the 23 south coast of California shipyards hold present contracts to carry them through 1944. Only half of the firms have future business for more than six months. At an east coast shipyard vessels for carrying tanks are now being converted to troopships, which makes for heavier demand for steel sheets for deckhouses and other equipment not necessary for the previous type of vessel.

Subject to possible changes, but probably representing the final program, tin mill product output for the first quarter of 1944 has been set at 626,700 tons. This is higher than the first quarter program in 1942, which although set up for 628,000 tons finally turned out to be about 567,300 tons.

The first quarter of 1944 program by months is: January, 166,700 tons; February, 220,000 tons; March, 240,000 tons. A breakdown on the distribution of the expected first quarter output looks like: Cans, 425,700 tons; closures, 50,000 tons; all other, 152,000 tons.

Preliminary estimates for the second quarter of 1944 indicate an output of about 725,000 tons, heavier than in the second quarter of 1942.

WPB has announced its intention to give special scheduling assistance to certain components delaying the farm machinery program. Makers of construction equipment are being urged to increase production of parts and will be assisted by WPB. Railroads are expected to obtain a better break on their rail requirements in the fourth quarter than has been the case for some time. Plans also are under way to expand rail shipments during the first and second quarters of 1944. Before orders can be placed, it is said WPB must make a more complete interpretation of its recent ruling that no orders could be booked until they have been certified under CMP.

Little improvement in iron and steel scrap supplies has been shown to date despite the current campaign. Some steel mills are complaining that they are not getting enough open hearth scrap. The situation is particularly tight in the East in steel mill and foundry cast grades. On the West Coast the lack of cast iron scrap has become a major problem.

Steel mills are finding the manpower situation increasingly difficult. This is the case especially in finishing mills. For example, the bolt and nut division of one steel firm has found it impossible to maintain peak operations and shipments because of the shortage of help. The division is now directing steel that would be used in the manufacture of nuts and bolts back into other lines because the plant can't handle it.

WITH eight billion dollars' worth of war contracts cancelled already and twice that amount likely to be scratched out when the European war finally ends, Washington begins to discern the outlines of a real problem. Terminated contracts are

News Highlights in This Issue

Drive to Switch Orders to Electric Furnaces Makes Headway; Free Market Likely

By DON JAMES, News and Markets Editor

• • • "The fluidity of modern warfare" is the expression being used fondly at Washington in some military quarters to explain such a plight as that which recently beset electric furnace alloy steel makers, who at the start of September found themselves with more production capacity than ever before and a dearth of orders.

As a temporary proposition the Iron and Steel Division of WPB forced steel mills to transfer open hearth alloy steel orders to electric furnaces. Probably around 60,000 tons were transferred in October, including many orders for aircraft steel, which helped electric furnaces to operate this month. The drive is continuing, with expectations that a specific order may be issued indicating the end products to be made from electric steel. WPB officials have been thinking they might even be able to transfer steel for gears and bearings to electric furnace grades. The shifting of shell steel was discussed, but apparently too many obstacles were in the path. However, gun barrel makers have been asked to specify electric furnace grades wherever possible.

It is quite likely that when the so-called shortage of carbon steel ceases, a free market for alloy steel will be declared by the Iron and Steel Division, enabling consumers to specify either open hearth or electric grades as they desire.

All-out capacity for the production of open hearth and electric furnace alloy steel probably will total 2,900,000 alloy ingot tons in first quarter of 1944. Stated requirements as totaled a few weeks ago were around 2,800,000 ingot tons, equivalent to about 95,000 product tons and it is expected that the actual orders which will finally reach mills will total about 675,000 product tons.

Alloy steel production hit a peak in March of this year at 1,284,000 net tons, and then started to decline. The demand at one time during the war was so acute that all available facilities were transferred to making it.

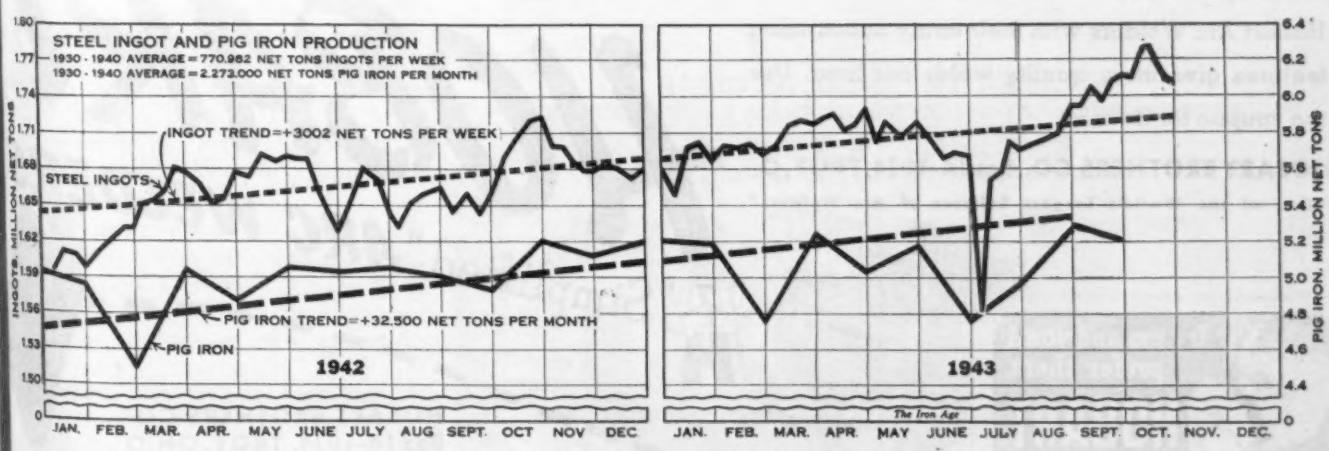
WPB Steel Division officials emphasize that the electric furnace expansions were based on the estimated needs of claimant agencies. At one time, they say, around 750,000 tons per month was slated for armor plate and aircraft requirements. Later the tank program was cut and armor plate orders went to the open hearths. Various ammunition jobs were trimmed sharply also, and one large ammunition project is scheduled to cease entirely next Jan. 1.

flowing much steel and other equipment through the services to the WPB regional offices which are charged with redistribution. One "out" would be the reconstruction of destroyed areas in Europe, except that Congress may oppose the giving of American money and goods, while the British might look askance at the plan and some U. S. firms might be reluctant to participate. It is believed in some quarters at Washington that the visit of Donald M. Nelson to Russia has connection with the plans for American assistance in reconstruction.

The big battle at Washington over contract termination policies appears to have resolved in favor of the Comptroller General who probably will be voted the right to review Army contract settlements, although the Army may win concessions permitting its approval of inventory disposition.

THE national steel ingot rate for this week is 99.5, unchanged from last week's revised rate of 99.5. Pittsburgh is up one point to 103.5; Chicago up one and a half to 101; Cleveland up one and a half to 96.5; and Eastern district up two and a half to 101.5. In some districts there was a decline, namely Wheeling which was down two points to 102; the Ohio River district down seven points to 96; and Birmingham down one-half point to 94.5. Continuing at the same rate as last week are Youngstown at 97, Philadelphia at 94, Buffalo at 106.5, Detroit at 104 and St. Louis at 106.5.

The Iron Age



Steel Ingot Production by Districts and Per Cent of Capacity

Week of	Pittsburgh	Chicago	Youngstown	Philadelphia	Cleveland	Buffalo	Wheeling	South	Detroit	West	Ohio River	St. Louis	East	Aggregate
October 21	102.5	99.5	97.0	94.0	95.0*	106.5	104.0	95.0	104.0	95.0	103.0	106.5	99.0	99.5*
October 28	103.5	101.0	97.0	94.0	96.5	106.5	102.0	94.5	104.0	95.0	96.0	106.5	101.5	99.5

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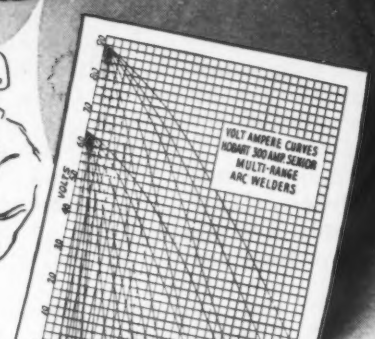

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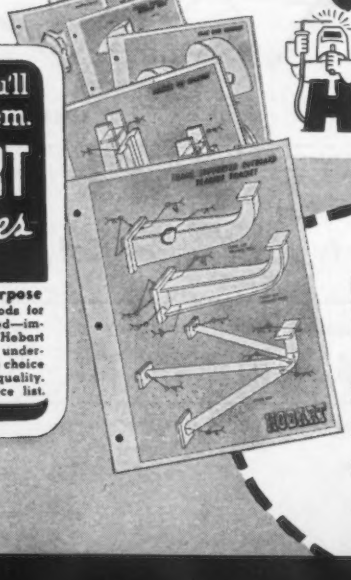

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AHEAD BY ONE SNAP: Comptroller General Lindsay C. Warren in action before House Military Affairs Committee last week.

Comptroller General Holds Edge in Battle Over Contract Termination but Army May Gain Concessions On Inventory Disposition

o o o

Washington

• • • As the big "guns" of the Army and the General Accounting Office were silenced this week before the House Military Affairs Committee on contract termination, it appeared that the epic Battle of the False Teeth had ended with Comptroller General Lindsay C. Warren at least one gnash ahead.

From a poll of Congressional opinion, it is now certain that a majority of the Committee will vote for GAO review of Army contract settlements, although concessions permitting Army final say-so on inventory disposition stand a good chance of winning important support.

A 75 per cent advance payment provision is sure to be contained in any bill favorably reported by the Committee. Loans, covering the remainder of the government debt, privately financed and guaranteed by the government with interest accruing to contractors so long as contracts remain unsettled, also will be provided.

A recapture proviso, applying to the advance payment faces opposition from Committee members who think GAO should participate in settlement negotiations with procurement agencies and give its final OK at that point. However, GAO supporters claim that this would hamstring the accounting agency and make it guilty of the same degree of delegation of authority it has criticised the Army for giving to contracting officers.

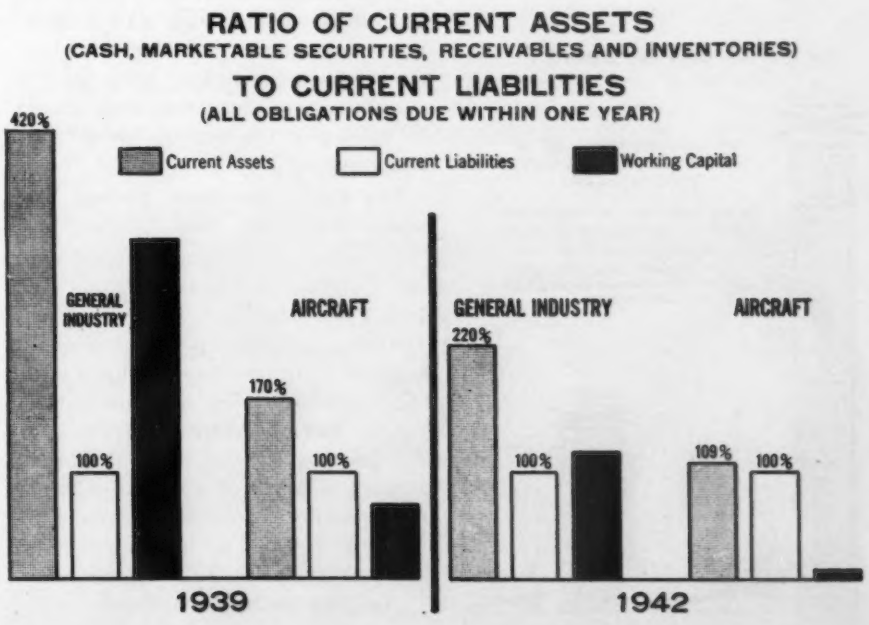
Basing loans on financial need, as advocated by Mr. Warren and criticised by Undersecretary of War Robert P. Patterson, may get the Committee's nod. But arguments that this would cause discrimination against small companies who have had little experience in dealing with government lending agencies and who would be at a consequent disadvantage are powerful.

It is also maintained by the opponents of setting up need as a rerequisite to getting loans, that his will further mitigate against small companies, since many are already financially shaky and bad bank risks.

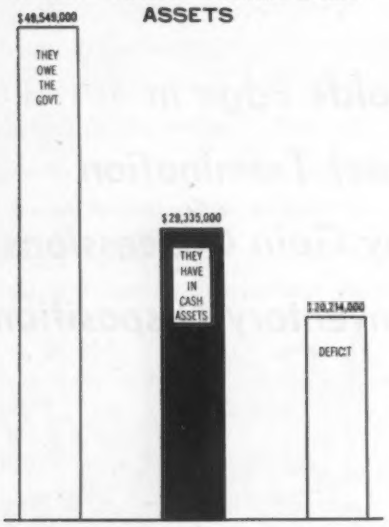
Accounting standards such as defining overhead, or allowable costs, have been considered by the Committee in executive sessions thus far. There is no indication that there will be any attempt to define what is inventory and what is work in process in legislation to be endorsed by the Committee.

Army regulations are soon to be amended to put termination settlements on a company or industry basis in the interest of expeditious and fully reconciled settlements. In other words, a company would settle with the agency having the preponderance of contracts with it. This move is not expected to draw GAO fire.

Army regulations do not attempt to define overhead, but have listed allowable costs. Inventory and work in



TYPICAL AIRCRAFT COMPANY OWES FAR MORE TO THE GOVERNMENT THAN IT HAS IN "QUICK CASH" ASSETS



process is not distinguished by the Army, but a full price is paid which included original material costs, plus labor costs and a profit.

The prospect of the post-war sale of scrap prices of many of these inventories of parts paid for in full is provoking serious Congressional attention to the certainty of great financial loss of the government on this account.

Despite the fact that GAO seems to have won the first round of the fight to have independent review of procurement agencies' settlements, the fight is expected to continue vigorously until Congress passes a cancellation law.

If another House Committee does not hold hearings, then the Army is expected to carry its appeal to the Murray Small Business (Senate) Committee where there are signs of more sympathy with the service viewpoint. Reports are that witnesses to be heard on the Senate side will bring charges of GAO inefficiency.

Lucian Shaw, assistant to the comptroller of the Lockheed Aircraft Corp. and representative of Boeing, Consolidated-Vultee, Douglas, Ryan, North American and Vega aircraft companies told Committee members last Thursday that a GAO audit would be inconsistent with speed and finality of settlement.

Mr. Shaw was a pro-Army witness who declared that unless Army cancellation procedure is applied to his company with a quick settlement, his company could very easily be forced to the wall within a few weeks.

"A regular auditing technique required under cost-plus-a-fixed-fee contracts would call for original invoices and submission of checks to show payment," Mr. Shaw said.

To illustrate the aircraft companies' claim that a detailed audit would take inordinately long Mr. Shaw said that Lockheed and Vega have the following numerous transactions in a year:

Item	Number
Time cards	46,000,000
Invoices	780,000
Receiving memos	768,000
Material requisitions	1,860,000
Checks	4,032,000

"We maintain a set of books for the purpose of summarizing all this data; it can very quickly be determined that our books are reliable. After such a determination, the government should be willing to rely on our books," Mr. Shaw argued.

The GAO was both praised and pummelled by Mr. Shaw. He said:

"As a matter of fact we feel that the General Accounting Office has done a very fine and constructive job in trying to keep up with the enormous new burdens imposed upon it by the war effort. For example a completely new, decentralized procedure has been established in the case of a large number of cost-plus-a-fixed-fee operations whereby the General Accounting Office reviews these matters currently.

"To demonstrate the huge sums which we constantly have at risk, however, you might be interested to know that despite this new procedure we have at Lockheed $100,000,000 of reimbursements which have not yet been passed by the General Accounting Office, out of a total amounts received under cost-plus-a-fixed-fee contracts of $124,000,000. At Vega, $62,000,000 out of a total of $128,000,000 have not yet been passed by the General Accounting Office. This can be financed as long as the contracts are in operation.

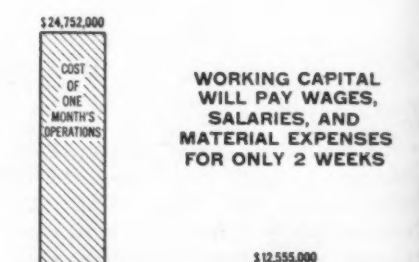
"Of course, it does not interfere with production. If, however, there should be an extensive delay with respect to similar amounts under contract termination, it would force us out of business."

Also against a GAO audit was Webb Wilson, representing the Aeronautical Chamber of Commerce of America. The Aeronautical Chamber's recommendations parallel the War Departments.

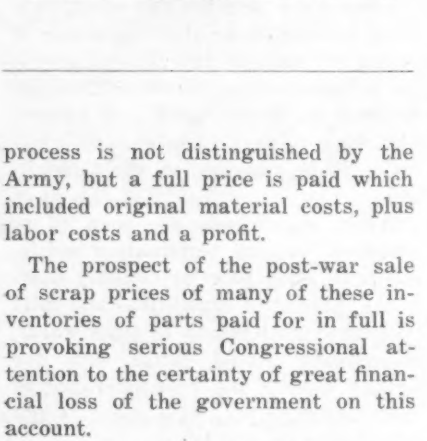
Mr. Wilson's point was the same as Mr. Shaw's — that aircraft companies are unstable financially, and could not escape bankruptcy if settlement time is prolonged. The accompanying charts show the industry's position.

CHART IV

TYPICAL AIRCRAFT COMPANY HAS BEEN DRAINED OF WORKING CAPITAL



THEY CAN GO BROKE!



First Hints of Army Plans for Industrial Demobilization Appear

Washington

• • • **The first tip-off** on Army plans for demobilization was given last Thursday to the House Small Business Committee investigating war surpluses by Undersecretary of War Robert P. Patterson.

The plans involve: (1) Reconversion of plants not producing munitions in peacetime: (2) sale of government-owned plants not needed for standbys or continued war production; and (3) sale of machine tools and industrial equipment upon contract termination with buying priority given to smaller manufacturing units which have not benefited from war orders.

Mr. Patterson said the plans were based on two factors: (1) The necessity for orderly demobilization to cushion the peace shock upon the nation's business; (2) the obligation to maintain a sound military establishment capable of future rapid expansion.

Warning that partial demobilization going on now does not mean slowing down of war production, nor that the end of the war is near, Mr. Patterson said that the War Department does not view reconversion as an abrupt change.

While the Committee which has been asking for a tally of service-owned property did not get this information from Army representatives, it did get a promise from Mr. Patterson that a report of 1943 third quarter sales of surplus property would be submitted next month.

Saying that he did not believe surplus goods will be a major problem until the end of the war, the Undersecretary admitted that the Army does not know how much property it owns because of its fluctuating state, and decentralized methods of distribution.

Representative J. W. Robinson, Democrat of Utah, said he doubted whether Army property regulations provided adequate publicity to surplus goods sales.

Mr. Robinson asked for an explanation of a press account that an Arkansas arsenal had sold materials at such low prices to a junk dealer that a 500 per cent profit was realized. The purchase involved new metal frames, nails and pipe which the junk-dealer sold at ceiling prices.

The Arkansas sale included cable clamps, steam valves and conduit fittings at $11 a ton. These items had a ceiling price of $55 a ton, not close to the real value of the property according to a newspaper account.

Mr. Patterson denied knowledge of the transaction, but promised an investigation.

Canadian Production Tempo Slowing

Ottawa

• • • **Easing off in the tempo** of Canada's war production program is indicated by announcements of war contract cancellations and slowing down in certain lines of production that previously had been considered of most vital importance to the war effort. Recently it was announced that some $90,000,000 would be sliced off the shipbuilding program in British Columbia, and that more effort would be centered on the building of fighting ships with curtailment in cargo vessel construction. It now is reported that scores of workers have been laid off at the Toronto Shipbuilding Co., a Government owned concern building fighting ships, and that consideration is being given to the laying off of between 800 and 900 more workers at this plant with the close of Great Lakes navigation. Mayor Conboy of Toronto has been instructed to make representation to the Minister of Munitions and Supply, C. D. Howe, with regard to the proposed lay off of shipbuilders at this plant. Walter Dawson, spokesman for the shipyard union workers said the situation at the plant had progressively deteriorated since a deputation had visited Mr. Howe last month to discuss conditions.

G. K. Sheils, deputy Minister of Munition and Supply, announced that changing war conditions and requirements have forced cancellation of contracts for manufacture of 100-round Bren gun magazines and will involve closing a part of the ordnance division of the plant of Kelvinator Co. of Canada Ltd., at London by the end of the month. Mr. Sheils stated that military authorities have advised that the Bren gun no longer is considered a highly effective weapon against aircraft and that only a limited number of 100-round magazines will be needed. About 300 workers will be released by the end of the month as a result of the cancellation.

ARMY PIPES ITS OIL: The need for speedy delivery of oil from supply ships and depots to fighting fronts has led the Army to establish engineer petroleum distribution companies which train at Camp Claiborne, La. Here a group suspend a portable pipe line from cables across a stream.

AISC Hears Post-War Predictions And Renegotiation Policies Clarified

Rye, N. Y.

• • • **A substantial volume** of post-war business for the steel construction industry was predicted by Dr. Charles F. Goodrich, chief engineer of the American Bridge Co., U. S. Steel subsidiary, at the annual convention of the American Institute of Steel Construction here last week.

Speaking on the technical aspects of construction in the post-war period, Dr. Goodrich said that it was to be hoped that WPB restrictions on materials and construction would be relaxed quickly. However, he pointed out, retention of certain of the war-time restrictions on specifications would be desirable, as fewer specifications make construction simpler and more economical.

Pre-fabrication which has fully come into its own through hurried war construction will retain its prominence after the war, he predicted.

Planning for post-war construction, Mr. Goodrich said, was already far advanced by city planning boards.

An interesting note in Dr. Goodrich's prophesies was the increased use of sheet and strip in new planning. Beauty in outward appearance which was said to be the keynote of all new designs has gone in for smooth surfaces, precisions shadow effects and decorative treatments.

Welding, according to Dr. Goodrich should take a leading place in steel construction after the war due to its many successful applications during war building. The welding of high strength steels is still the big problem facing welding from the steel constructor's point of view, he said.

Some question of whether the problem would resolve itself into the adoption of two kinds of structural steel, one for welding and one for riveting, was called unlikely by Dr. Goodrich. He said that welding advances would obviate the necessity later.

Dr. Goodrich concluded by stating that high tensile steels and higher working stresses would be the constructors' tools of tomorrow. Both lower steel and fabricating costs were set as goals.

• • • **The renegotiation** policies of the War Price Adjustment Board were defended as justified even though the frequent subject of severe criticism in an address given by Maurice Hirsch, vice-chairman of the War Department Price Adjustment Board, before the annual convention of the American Institute of Steel Construction here last week.

Renegotiation is strictly a pricing function, he said. It has only been necessitated by the placing of contracts at fixed prices at a time when costs could not be established. Naturally when production has been progressing on a contract and volume has made possible the lowering of costs beneath contracted price, still leaving a fair margin of profit, it is to the benefit of the tax payer to remove excessive profit from the manufacturer and stop excessive spending for war materials.

• • • **Renegotiation** does not always mean a lowering of contract prices, Mr. Hirsch stated. In many instances losses are permitted to be recovered.

A fair profit, presumably necessary as an incentive and also to build a post-war conversion fund has proved to be a factor which can not have a universal rule applied. For instance, Mr. Hirsch said, only about 20 per cent of all war contractors actually need a post-war reconversion fund because only this number have been required to make any drastic changes for war production.

On the subject of renegotiation before taxes, Mr. Hirsch said that since all war producers were being paid indirectly by the tax payer through the government, permission to add corporate taxes to the government's bill for production would simply result in passing the war plant taxes right back to the taxpayer for payment.

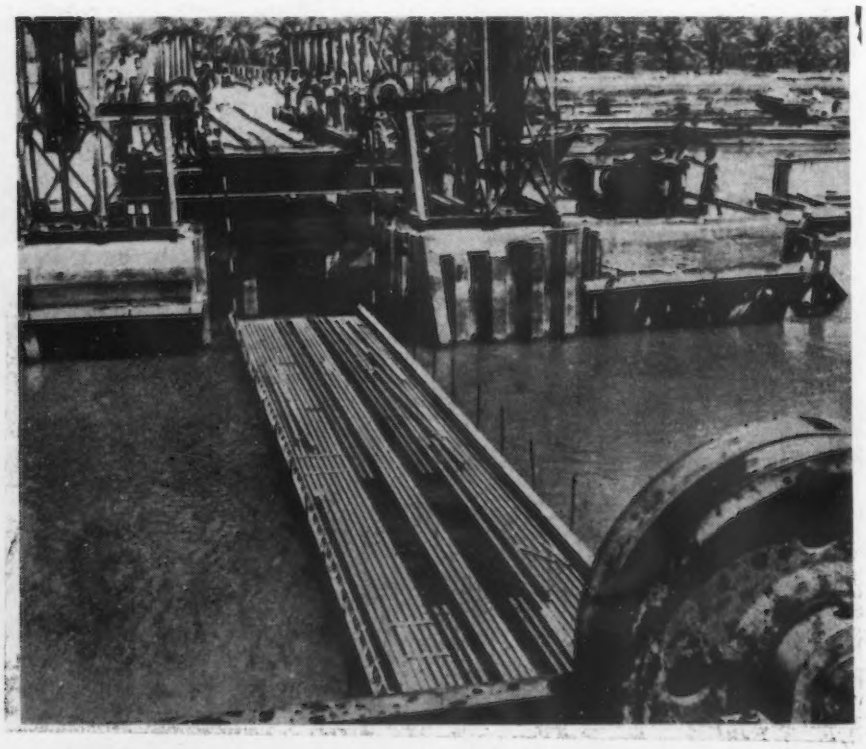
AISC Elects Officers

• • • Following the annual convention of the American Institute of Steel Construction Oct. 19, 20 and 21 at the Westchester Country Club, Rye, N. Y., the new directors met and elected the following officers to serve until the annual meeting of the board in 1944:

President: Clyde G. Conley, the Mount Vernon Bridge Co., Mt. Vernon, Ohio; First Vice President: Clyde MacCornack, The Phoenix Bridge Co., Phoenixville, Pa.; Second Vice President: Edward K. Klingelhofer, Pittsburgh Bridge & Iron Works, Pittsburgh; Treasurer: T. R. Mullen, Lehigh Structural Steel Co., Allentown, Pa.; Executive Vice President and Assistant Treasurer: Robert T. Brooks; Manager: L. Abbett Post; Secretary: Roberts B. Thomas.

The election of the following to serve as directors of the Institute for three years was announced: Clyde G. Conley, Mount Vernon Bridge Co.; Art J. Dyer, Nashville Bridge Co., Nashville, Tenn.; Henry Bohnsack, International Steel Co., Evansville, Ind.; Edw. K. Klingelhofer, Pittsburgh Bridge & Iron Works, Pittsburgh; Clyde MacCornack, The Phoenix Bridge Co., Phoenixville, Pa.; R. C. Mahon, The R. C. Mahon Co., Detroit; P. F. Gillespie, Judson-Pacific Co., San Francisco; W. M. Wood, Mississippi Valley Structural Steel Co., Decator, Ill.

A UNIQUE BRIDGE that spans the Shatt-Al-Arab river in Iraq permits ships to pass over it instead of under it. The bridge has a center span that sinks to the bottom of the river. The bridge has a span of 92 ft. and weighs about 35 tons.



• Senator John H. Bankhead (D) of Alabama. Lawyer. Member of Senate since 1930.

• Rep. Michael Mansfield (D) of Montana. Mining engineer, ex-soldier, sailor, Marine, professor.

• Senator Edward V. Robertson (R) of Wyoming. Boer War veteran, livestock, merchant. Senator since 1942.

• Senator Gerald P. Nye (R) of North Dakota. Member of Senate since 1925. Publisher.

• Rep. Francis Case (R) of South Dakota. Newspaper publisher, rancher, lawyer, ex-Marine.

• Senator Pat A. McCarran (D) of Nevada. Chairman, Senate Industry Decentralization Steering Committee. Lawyer, judge.

• Senator Guy M. Gillette (D) of Iowa. Lawyer, Spanish-American and World War veteran, judge.

• Senator Abe Murdock (D) of Utah. Lawyer, former city attorney and councilman of Beaver, Utah.

• Rep. Thomas D. Winter (R) of Kansas. World War flyer, court reporter, lawyer.

• Rep. Wright Patman (D) of Texas. State legislator, district attorney, war veteran.

• Rep. John M. Coffee (D) of Washington. Chairman, Pacific Coast and Industry Decentralization Steering Committees. Lawyer.

• Senator John Thomas (R) of Idaho. Livestock operator and successor of William E. Borah.

Here Are Solons Who Will Run Heats Over Steel Decentralization

• • • These are the senators and representatives who will consider Senator Pat McCarran's proposal to put two steel mills in every pot. If the previously reported (IRON AGE, Oct. 14, page 120) McCarran resolution officially establishing a special committee does not pass, these groups are expected to act in concert on the question of decentralization.

• Rep. Cecil King (D) of California. State legislator, war veteran, business man.

• Rep. Malcolm C. Tarver (D) of Georgia. Lawyer, state legislator, judge.

Congressional Economy Aims Queried

Washington

• • • In the final open session of the Ways and Means Committee hearings on the Administration's $10,500,000,000 tax program, Rep. Taber, Republican, New York, presented his economy views to the committee.

Previously, the Republican members of the Committee announced that they would support no new revenue measures. This action virtually sounded the death knell to the Administration's proposals for higher personal and corporate income taxes and increased excise taxes.

Rep. Taber's suggestions (THE IRON AGE, Oct. 16, page 119) were well received by the committee and the sentiment within that group indicates that the Congress seriously is economy bent. However, Washington observers are wary about any economy moves, until they are actually put into effect, as in the past such moves have been mere political footballs.

Before the committee on Oct. 20, Mr. Taber went into some detail on the manner in which he believes $4,658,000,000 could be pared from government expenditures. He said:

"1. On Oct. 15 the semi-monthly Treasury Statement appeared showing expenditures at the rate of $7,250,000,000, a figure below the average since July 1. (2) The Comptroller General, Hon. Lindsay Warren of North Carolina, has appeared before the House Military Affairs Committee and exposed enormous waste and unnecessary buying on the part of the War Department. (3) An announcement has been made by the War Department of the discontinuance of the Martin two-engine bomber, not because it was a failure, but because we had more effective types to build. Result: Contracts cancelled. (4) The War Department announced to the Byrd Committee that it had eliminated 145,000 out of 3,000,000 employees and it was apparent that the production of its units had increased with the streamlining. (5) Disclosures have been made that an enormous waste of manpower exists in shipyards and airplane factories.

"I am also advised that current and pending cancellations of contracts will cut out the expenditure of at least $8,000,000,000."

Impact of Soaring Corporate Taxes Upon Steel Is Analyzed

By WALTER W. RUCH

o o o

• • • **The impact** of soaring corporate taxes upon final net earnings was perhaps nowhere more graphically illustrated in a new kind of survey completed recently by the Securities and Exchange Commission in Philadelphia than in the iron and steel industry.

What the commission set out to do was to test the final net income of some 864 war-important companies as a per cent of invested capital. In this it succeeded, but the voluminous report it has placed in the hands of governmental agencies charged with the renegotiation of war contracts would seem in many instances the more notable for its concise illustrations of the effect of war-time taxes imposed upon the earnings of those companies.

Certainly the figures, with few exceptions, may not be reviewed by a candid observer without leaving the impression that the tax burden, which by contrast with earlier years seems overwhelming, now borne by American industry would leave no possibility for a break-through to inflation on this front. The tax figures are staggering and out of all proportion with the increase in net earnings.

The survey included 59 industrial groups, of which six are of interest to the iron and steel industry. These six are the makers of iron and steel foundry products, ten in all; the makers of miscellaneous iron and steel products, 17 in all; the pig iron producers, four in all; the rolling mills without steel making facilities, five in all; the steel producers with blast furnace facilities, 15 in all, and steel producers without blast furnace facilities, 12 in all.

There were two tests for inclusion in the survey. One was that each company have securities registered with the SEC under the Securities Exchange Act of 1934. The other was that it be important to the war effort. Thus, 63 companies in the iron and steel group were included. Together, they represented, numerically, 7.3 per cent of all the companies. From the standpoint of invested capital, however, their aggregate of $4,362,000,000 represented almost exactly 15 per cent of the $28,700,000,0000 of capital invested by all of the 864 companies.

For the purposes of the survey, the SEC deemed invested capital to include funded debt, non-current debt to affiliates, other long-term debt, minority interest, preferred stock, common stock, and surplus. The method used was to total these items and to divide the total into the final net profit of the same year. The dividend then would express final net profit as a per cent invested capital.

In this review of the results as they obtained among the iron and steel groups, the final net profit as a per cent of invested capital may be studied along with, because, indeed it complements, the soaring tax burden imposed upon these companies. The review will treat of the groups in the order of their size measured by the amount of their invested capital.

The first among the six groups, of course, is that embracing 15 steel producers with blast furnace facilities.

This group had the tenth lowest final net profit in 1941 as a per cent of invested capital among the 59 studied. According to the SEC, the 15 companies in 1941 had invested capital amounting to $3,946,105,000. This was not much higher than in 1936, the first year covered in the study, when the 14 companies then in the group had invested capital amounting to $3,726,345,000.

Now, let us carry the comparison between the two years into the column headed, "Net profit before prior claims, interest and income taxes." The figure for 1941—$685,464,000, or 3.6 times the 1936 amount of $190,330,000. War contracts, of course, accounted for almost all of the increase, and, as we shall see, war taxes were to drain most of it away.

Prior claims and interest actually decreased between 1936 and 1941, $32,016,000 as against $28,165,000.

Now look at the tax picture. In 1936, the provision for income taxes was $27,183,000, or one-seventh of the $190,330,000 before prior claims, interest and income taxes. In 1941, the provision for income taxes was $380,819,000, or 14 times as much as in 1936, although net profit before prior claims, interest and income taxes had increased only 3.6 times.

As a result, the net profit after all charges in 1936 was 3.52 per cent of invested capital, while in 1941 it was 7.01 per cent. The latter figure, a sizable increase when viewed by itself, still is 2.90 per cent below the average of 9.91 per cent found for the average of all 864 companies in 1941. Within the group, it compared with 6.49 per cent in 1940, 3.22 in 1939, and 5.30 in 1937. In 1938 the group had a net deficit that was .30 per cent of invested capital.

Figures for the individual com-

(CONTINUED ON PAGE 110)

WORK OF ALLIED BOMBERS: Rails, aircraft engines and plane parts are scattered over the ground in the Freight yards at Crotone, Italy, a target for Allied bombers. Fliers checked on their accuracy after the yards were captured.

Treasury Believes Tax Refunds Sufficient to Absorb Post-War Losses

Washington

• • • **It is evident** that the Treasury believes tax refunds allowed under the present system of carry-backs should be sufficient to absorb post-war losses in industry, provided they are incurred shortly after the termination of hostilities.

This was brought out plainly at the hearings on the Administration's tax proposals before the Ways and Means Committee when Randolph Paul, General Counsel of the Treasury, introduced a lengthy study compiled by Treasury tax experts entitled, "Post-war Expenses Relating to Wartime Income."

The Treasury's findings and estimates are particularly pertinent with relation to carry-backs, peacetime products, post-war costs and other current subjects of vital interest, since they bear on the much-discussed matter of readjustment. In the figures cited the Treasury gave illustrative examples of war producers in steel, machine tools, ships and aircraft who will face serious readjustment problems.

The Treasury's proposals also would provide a speeding-up of refunds allowed under the carry-back system. There has been much agitation against the long wait required as the provision stands at present.

Mr. Paul, in summing up the Treasury's position on a speed-up, told the Committee:

"The idea is to meet the very proper concern of these corporations that 'Well, a refund won't do me any good after the war because it will take some time to audit the returns and I won't get it right then when I have to pay these expenses, these wages'."

"We say, 'All right, that is fair enough. You take a certain proportion, say 75 per cent of your anticipated refund resulting from the carry-back, whether it is of losses or expenses, take it immediately against your tax liability and thereby improve your cash position'."

Concluding, Mr. Paul said, "Then there will have to be some safeguards provided against the abuse of such provisions, but I think they can be worked out, and I think we may make a genuine extension of our present liberal provisions in favor of corporations in respect to carry-backs, and I think we can solve by that technique all we can solve in the tax field."

In addition, the Treasury has also proposed certain refinements in the carry-back provisions to provide for cases not adequately covered under the present plan.

When framing the 1942 Revenue Act, Congress, as a substitution for allowing reserves, enacted a two-year carry-back of net operating losses and unused excess profits credits, in order to average income over a longer period than the annual accounting period allowed and to allocate post-war losses directly to wartime income. Under these provisions, if losses are incurred in any year, they may be offset

(CONTINUED ON PAGE 118)

Operation of the carry-backs for individual corporations, classified by peacetime product and by type of post-war cost

(In millions of dollars)

Corporation	Approximate base for the carry-backs [1]	Items bearing on the magnitude of post-war losses					Maximum amount of refund [4]	
		Company's estimate of post-war costs [2]	Inventories 1942	Net plant 1942	Cost of sales 1942	Amount of dismissal compensation [3]	Income tax	Excess-profits tax
I. RECONVERSION COST								
Automobiles	$562.0	$40.6 post-war contingencies and plant rehabilitation.	$466.3	$371.5	$1,832.2	$14.1	$188.2	$60.8
II. CONTRACT-CANCELLATION LOSSES AND DISMISSAL COMPENSATION								
Aircraft	213.0	$24.2 post-war readjustment	289.5	28.0	669.5	Not available	8.8	143.8
Ships	15.6	$2.6 contingencies	7.5	1.8	66.9	do	2.8	7.2
Electrical machinery	143.8	$5.3 contingencies	164.4	89.9	378.8	$7.9	19.4	79.8
Iron and steel	371.4	$17.6 contingencies	168.0	442.1	1,221.8	$21.5	31.8	263.2
III. DEFERRED MAINTENANCE								
Transportation equipment	94.0	$6.7 post-war readaptation and manufacturing contingencies.	28.8	112.2	167.6	$1.8	20.6	43.6
IV. LOSS OF POST-WAR MARKETS								
Machine tools	31.2	$1.4 contingencies	10.0	3.0	30.3	Not available	3.8	18.6
Machinery	24.2	$1.2 inventory adjustment; $0.9 post-war refund	5.7	3.0	[5] 10.7	do	2.0	16.6
Machine tools	26.6	$3.0 contingencies	2.0	1.5	14.6	do	0.8	18.4

[1] Net income before taxes in 1942, plus an assumed income in 1943 equal to 1942.
[2] Accumulated reserves through 1942.
[3] Assuming $150 (approximately one month's salary) is paid to employees in 1942 in excess of employment in 1939.
[4] Estimated taxes in 1942 and 1943.
[5] Estimated on the assumption that the 1942 ratio of cost of sales to sales was the same as in 1941.
Source: Moody's Industrials and Public Utilities.

Lincoln and Blough in Warm Debate Over Renegotiation of War Contracts

Cleveland

• • • Nearly 1000 Cleveland business men and industrialists heard James F. Lincoln, president of Lincoln Electric Co., and Carman G. Blough, chief of the Contract Review Branch of WPB, a member of the newly formed Joint Price Adjustment Board and WPB's representative on 42 price adjustment boards, debate war contract renegotiation at a City Club meeting, Oct. 23. Blough, the first speaker, claimed that the enormous task of getting industry into war production as quickly as possible resulted in enormous increases in government purchasing and costs to the government were in many cases completely out of line. Consequently, without competitive bidding, profits were often excessive, he said.

Blough maintained that the company that has tried to operate efficiently, develop better manufacturing procedures, and reduce costs is left by the Price Adjustment Boards after renegotiation a profit materially greater than the company that has not done a good job in such respects. On the other hand, a company inefficiently operated is penalized by renegotiation.

Mr. Lincoln flatly denied both of these claims. Lincoln stated that "if efficiency is low enough, a company will not be renegotiated." He claimed that if efficiency of his company had been reduced to a point similar to that which manufacturers in the same line are operating, the government would not have been concerned. However, he said, "As ours is the only company in our line that is making money on our product at present, and we sell at lower prices than the others, we have been charged $3,250,000 on 64 per cent of 1942 business."

Blough claimed that renegotiation does not destroy company incentive because money is not the incentive for doing a good war job. However, countering Lincoln's claims that taxes would take care of excess profits, he stated that tax rates high enough to drain off all excess profits would destroy incentive because taxes are applied without consideration for efficiency in an organization. Mr. Blough's main claim was that if American industry studied costs and got prices down in line with costs, renegotiation would be out of business overnight.

Interesting questions were asked the speakers from the floor after the debate by attendants at the meeting. Some of these were:

"Why not submit to the judgment of the board and then appeal the case through a court of claims?"

Mr. Lincoln—"With cases from the last war still on court dockets, the damage done by the boards could never be adjusted."

"Is there any distinction in renegotiation between a company long in business and operating on its own capital and one operating mainly on government money?"

Mr. Lincoln—"None has been apparent."

Mr. Blough—"The boards do consider this and it is one of the major considerations in renegotiation."

"Is it true that much of the value of renegotiation comes from recoveries made from companies that have unjustifiably increased salaries and expenses?"

Mr. Blough—"It is a fact that many small companies with close stock control have had unproportionately large salary increases and other inefficient expenditures that have been disallowed by renegotiation.

"Is there any real choice to a renegotiating agreement between a company and the Price Adjustment Boards if the boards will withhold payments and orders?"

Mr. Blough — "Payments will be withheld only in amounts that cover the established excess profits. The order threat has never been verified, but the government can't afford to do this. If other producers in the field exist, then such orders could be withheld from such a manufacturer.

"Why wouldn't it be advisable for Congress to set up a board of review on disputed renegotiated contracts?"

Mr. Blough—"The Service Departments hold 80 per cent of the business. A board of review exists in the War Department. A congressionally established board of review wouldn't be advocated because renegotiation is a matter of judgment and would need a complete new hearing, thus necessitating going over the entire procedure again and would result in a clogging up at the board of review.

War Output "Disappointing"

Washington

• • • September's overall munitions production was approximately the same as for August and "cannot be regarded as anything but disappointing" according to Charles E. Wilson, acting chairman of WPB. He excepted this statement with the admission that the production of four-motored bombers was up six per cent.

His report included: Completion of 106 Liberty ships for the month, four below August; tankers 22, a new monthly high; naval vessels below August; signal equipment up six per cent; ammunition up three per cent; aircraft up two per cent.

Aircraft production equalled 7598 planes and looked "good" so far in October for a further increase. About 69 per cent of scheduled 1943 merchant vessel tonnage had been completed through September. Artillery and tank gun ammunition gained 11 per cent but total ammunition output climbed only three per cent due to a lag in small arms sizes.

Production for the 21 months' period included: 110,000 planes, 60,000 tanks and chassis, 21,000,000 deadweight tons of merchant shipping, 3,000,000 displacement tons of naval vessels, 170,000 pieces of artillery, 1,500,000 machine guns, 6,700,000 sub-machine guns and rifles and more than 26 billion rounds of ammunition.

OPA Appoints Six to Lock Advisory Committee

• • • **Six executives** of companies engaged in the manufacture of locks and lock sets were named to its Lock and Lock Set Industry Advisory Committee by OPA.

Appointed to the committee are: W. S. Johnson, general sales manager, P. & F. Corbin Mfg. Co., New Britain, Conn.; Charles L. Helzman, president, Earle Hardware Mfg. Co., Reading, Pa.; Marron Kendrick, sales manager, Schlage Lock Co., San Francisco; John J. Meyer, vice-president, Lockwood Hardware Mfg. Co., Fitchburg, Mass.; W. W. Peterson, assistant to president, National Brass Co., Grand Rapids, Mich.; E. F. Sutphin, general manager, Skillman Hardware Mfg. Co., Trenton, N. J.

Clarification Did Not Raise Pig Iron Differentials

Washington

• • • In THE IRON AGE of Oct. 21, page 96, it was erroneously stated that OPA had increased price differentials on silicon and manganese content in pig iron. OPA made no change in the differentials, but issued a clarifying amendment pertaining to these differentials.

House Military Committee Asks Chamber for Settlement Proposals

Washington

• • • **Representative Albert Sparkman,** Democrat of Alabama, keynoted House Military Affairs Committee sentiment on Monday when he asked Paul E. Shorb, United States Chamber of Commerce Representative, to submit recommendations to compromise the contract settlement dispute between the procurement agencies and the General Accounting office.

Mr. Sparkman said: "Instead of the witnesses which have appeared before this committee trying to justify their views as to which agency should control contract termination settlements, why doesn't someone submit a proposal which divides the field of negotiation and audit."

Mr. Shorb said he thought that this was a good idea, and that the chamber, which opposed a detailed audit would give the committee its opinion in the matter at a later date.

The most important new recommendation of the chamber was that Congress should specify the bases of allowable costs and profits, as guides to the proper determination of advance payments, final settlements and adjudication of disputes.

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Courts to Be Suggested Soon As Recourse from Renegotiation Ills

Washington

• • • The House Ways and Means Committee will soon report a bill which will revolutionize renegotiation processes if passed by Congress.

Instead of no recourse to any reviewing body, contractors will be invited to resort to the courts for redress of their grievances against price adjustment boards.

Standard commercial articles made before January, 1941, and all on the shelf-goods entering into a war munition would be exempted from renegotiation. This means standard articles such as bolts and nuts and general purpose machine tools would escape the clutch of negotiators.

A formula, which all of the executive agencies said could not be worked out by Congress, has been proposed. The emphasis will be on costs and prices instead of excessive profits.

Internal revenue allowances, as provided in the tax laws will be recognized as valid deductions from the amount to be renegotiated. Credit will be allowed for the payment of state taxes.

Renegotiation will be after taxes instead of before as practiced by price adjustment boards. This provision has been universally opposed by the executive departments as making renegotiation final and expeditious.

All renegotiation legislation will be made prospective—that is, the date on which the contract was entered into will govern, with no reference to completion dates or guaranty period considered. This will mean that millions of dollars will have to be returned to contractors which has been taken from them by price adjustment boards, which have had the impression that delivery dates were governing.

So long as the contract was entered into before the date on which the procurement agency was empowered to renegotiate, that contract will be exempt from renegotiation under the new law.

A single agency will be created to administer all renegotiation.

Post-war reserves will be provided by the committee's new tax legislation.

Publication of comparative renegotiations will not be ordered by the new bill, but formula plus review by courts guarantees uniformity of treatment in the opinion of committee members.

Bowles to Succeed Brown as Price Chief

Washington

• • • **The President on Monday** sent the name of Chester Bowles to the Senate for confirmation as Price Administrator to succeed Prentiss Brown, resigned. The selection of Mr. Bowles, who was general manager of the price organization, had been expected because of the good work he did in reorganizing OPA. His outstanding accomplishments included the ousting of theorists and their replacement by businessmen together with the setting up of industry advisory committees, moves which had the support of Mr. Brown. When he reluctantly took over the job of Price Administrator, Mr. Brown indicated that he would resign as soon as OPA had been reorganized on a workable basis.

WPB Standardizes Lubrication Equipment

Washington

• • • **Simplification and** standardization of more than 500 types of lubrication equipment were established by Order L-314, issued last week.

Chamber Offers Contract Settlement Plan

Washington

• • • **The principal United States Chamber of Commerce contract settlement recommendations made to the House Military Affairs Committee on Monday were as follows:**

1. Subject to a 30-day preliminary review, a 75 per cent mandatory advance payment should be made to each war contractor on his certification, including subcontractors and suppliers.
2. Withholding of the advance if review calls for it—semi-contractors would be given notice to post bond for the amount of the advance, submit certificates, or other evidence that amount claimed is correct.
3. Additional amounts should be provided above the advance, guaranteed or loaned directly by the government, at 4 per cent interest.
4. Allowable costs and profits should be fixed as settlement guides.
5. When advances exceed final settlements, advances should be treated as loans, repayable at 6 per cent interest, except that a prime contractor should not be financially responsible for advances made through him to his subcontractors.
6. The contracting officer should not be personally liable for excessive advance payments.
7. If Congress brings GAO into the picture, the comptroller general should come in as a negotiator in preliminary review, without veto power, or power to audit.
8. Procurement agencies should be authorized to make final negotiated settlements.
9. Extensive audits should be avoided where the contractor is responsible and has an adequate accounting system.
10. Settlements should be final except for fraud.
11. Comptroller general may participate in final settlements, but without veto power.

Steel Cut "Very Substantially" By Coal Strike, Batcheller States

Washington

• • • **Hiland G. Batcheller,** WPB operations vice-chairman, told THE IRON AGE on Monday that the coal strike in Alabama and Indiana had cut into steel production "very substantially."

This confirms the statement of Charles E. Wilson, acting chairman of WPB, that the strike came at a time when the nation's steel mills had only two weeks' supply of coal to fire their furnaces.

Although the drop in coal production is not as large as the 23,000,000 tons loss resulting from the strike in the Pennsylvania and Virginia regions last spring, this strike is even more dangerous, Mr. Wilson explained, because of the national shortage of reserve supply and the approach of winter, with its additional demands for home heating.

The present shutdown at the mines occurred not long after the response of labor and management in the steel industry to WPB's "steel for victory" drive had boosted monthly steel production to 102 per cent of capacity. Any prolonged shutdown in these mines, Mr. Wilson explained, would not only nullify those gains, but would give the whole war production program a serious setback—which means a setback to our fighting forces at a time when they are attacking the enemy on every front.

For the week of Oct. 11-16, figures from the coal mines of Alabama and Indiana show a drop of 300,000 tons from normal production; but the effect on steel production in the Birmingham area is far more serious than that figure alone would suggest, Mr. Wilson pointed out.

Making his statement last Sunday, Mr. Wilson said that at one steel mill five open hearth furnaces had already shut down. Normal production at this mill is 160,000 tons of product steel a month; today production is down between 35,000 and 40,000 tons, and total shutdown is expected within 10 days unless coal can be moved in.

Another mill reported that about 15,000 product tons a month had been lost since the strike, cutting sharply into its normal monthly production of 43,000 tons. The shipment of ingots has been maintained, however, at greatly increased cost from distant sources.

National coal production, previous to the strike, was 2,000,000 tons a day. It must be considered, Mr. Wilson pointed out, that approximately one ton of coal is needed for each ton of steel produced, and that steel production further depends on a continuous flow of hot metal, which in turn depends on a steady stream of coke.

Editor's Note: Mr. Wilson's estimate of one ton of coal to one ton of steel is considered to be too low. The general average is more nearly 1½ to 1¾ tons of coal to one ton of steel.

A constant supply of coal, Mr. Wilson explained, is essential to efficient steel production. Furnaces that have to shut down—and five out of six at Tennessee Coal & Iron and two at Republic south had already shut-down—take considerable time to heat up and put back into service.

Already shipyards, not only on the Gulf Coast, which has been hit hardest, but on the West Coast and in New England States, are beginning to feel the pinch. That is because the biggest single item in production in the Birmingham area is steel for ships, both plates and structural steel.

If the strike were to continue a month, forcing total shutdown of the biggest steel plant in that area for lack of coal, Mr. Wilson explained, it would mean that tankers, liberty ships and an indeterminate number of regular cargo vessels would be held up for lack of steel plate.

But in addition to the steel that is being made in the Birmingham area for liberty ships and other vessels—good bit of the production goes into other direct war uses such as ammunition—both small arms and artillery—shipping drums and barrels, construction machinery and parts for maintenance and repair.

Goal of WPB in 1943, Mr. Wilson said, was production of 90,000,000 tons of steel. And since war needs must come first, the present drop in production of the coal needed to make that steel will necessarily affect the allocation of steel for production of essential civilian goods.

"This coal strike," Mr. Wilson added, "is hitting us at a bad time. Surely no American wants to see our steel plants closed down for lack of coal, or wants to see our shipyards idle, or wants to see munitions held up that are needed for fighting overseas. But that may well happen if the coal situation is not solved, and solved swiftly. It is a key problem that concerns every American right now."

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J & L Mine Strike Hints New Outburst

Pittsburgh

• • • **As the Western Pennsylvania** soft coal fields were about to breathe easier earlier this week, because of no major outlaw mine stoppages, 1400 miners at Jones & Laughlin Steel Corp.'s big Vesta coal mine near California, Pa., struck late Monday. This location was a sore spot in the last series of unauthorized strikes, which resulted in 30 miners being indicted under the Smith-Connally law. At that time the government had control of the mines, which have since then been returned to the company. No government action can be taken now unless the mines should be taken over again.

Union leaders at the Vesta mine insisted that the walkout was not due to the mine wage controversy, but was caused by the alleged firing of a blacksmith, which the leaders say forced the miners to go an unusual distance for repairing of tools. Labor observers here, however, have taken the view that this strike was another indication of "no contract, no work," and the extended negotiations over the wage situation.

There is no optimism here over the possibility of a settlement in the outlaw strike question. Most observers believe that if the wage and contract controversy is not settled by this Sunday, next Monday may see sporadic mine stoppages, since the John L. Lewis truce will end at that time unless an extension is made.

While the Bituminous Coal Insti-

COMING EVENTS

Nov. 3, 4—Meehanite Research Institute of America, Inc., Cincinnati.
Nov. 10, 11—Industrial Hygiene Foundation, Pittsburgh.
Nov. 17, 18—National Founders Association, New York.
Nov. 19—Steel Products Warehouse Association, Inc., Chicago.
Nov. 29 to Dec. 3—American Society of Mechanical Engineers, New York.
April 2 to 5, 1944—The American Ceramic Society, Inc., Pittsburgh.

tute has declared that the United States has one of the largest coal stockpiles in history, this is of little help to at least two major steel companies in the Pittsburgh district, which have only a few days supply ahead of their by-product coke ovens.

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• • • **A week-end strike** of about 750 employees of the Bohn Aluminum & Brass Corp., Adrian, Mich., is reported as the fifth work stoppage there in two months. Slowness in attaining a working agreement is charged.

Approximately 175 employees of Farrar & Trefts, Inc., Buffalo boiler makers, have returned to their jobs after a two-day strike.

A walkout of 50 workers in the oven department of Donner-Hanna Coke Corp., Buffalo, lasted only 24 hr. but cut artificial gas and coke production nearly 50 per cent during that time. In both cases, strikers complained against alleged WLB delay in handling their cases.

Approximately 1000 machine shop workers at Worthington Pump & Machinery Corp., Buffalo, walked out Oct. 23 in what union officials termed a "wildcat work stoppage." A company spokesman said the walkout was apparently a demonstration to try to hurry WLB action on issues in dispute.

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Coal Strike Spreads to Eight States; Nation's Largest Coal Stockpiles Reported

New York

• • • **On Tuesday the wildcat** walkout of coal miners showed poor signs of improvement after having spread in about two weeks to the eighth state from its beginning in Alabama and Indiana. So far the pleas of John L. Lewis, local unionists, and the WLB have failed to return more than a few men to the pits. Estimates of as high as 35,000 idle are now current.

Much depends on the decisions of the WLB, confronted with acceptance or rejection of the Illinois Operators plan which would give the miners approximately $1.50 per day portal-to-portal pay plus other extras. Acceptance of this plan would grant the miners approximately what they started out to get and probably establish a model plan for settling the problem of the entire coal industry. An alternate plan granting only about $1.12½ per day is expected to be offered by WLB to the miners first.

Although the crews of six of 18 major mines supplying the steel industry in Alabama are reported back at work, iron and steel production there is still suffering. At least eight blast furnaces and six open hearths in the Birmingham area are believed to have been banked in the last ten days. The ore mines in the South have been put on reduced time. Total steel production lost by the nation to date through four major mine strikes this year totals in excess of 220,000 tons.

Soft coal production for the week ending Oct. 16 is reported almost 500,000 tons off from the preceding week. Anthracite is also reported down about 19,000 tons. Total coal production for the year is placed at 468,425,000 tons leaving 131,575,000 tons to meet the 600,000,000 ton quota. In the meantime, the Bituminous Coal Institute reports stockpiles of 100,000,000 tons of coal, the greatest in the history of the nation. Dispersing Washington gloom on the subject, the Institute says that the 600,000,000 ton goal can be met and that an additional 50,000,000 tons could be added in 1944.

Despite such factors observers still look with apprehension at the evidence. This is the fourth major coal strike in 1943 without any definite settlement of the cause nor too imminent promise of one within the hold-the-line order. The first strike stopped the entire industry in May idling over 500,000 miners in all fields. Two more strikes of the same magnitude followed in June and the promises of the current one, unless satisfactory terms are granted the miners, may mean another full scale recurrence.

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Chicago

• • • **Illinois coal operators** still do not look for a nation-wide strike at the end of this month although they are thoroughly resigned to sporadic walkouts. Decision by the War Labor Board on the joint operators and union application for adjustment of the Illinois wage agreement extending the work day and including traveling time is expected this week.

Currently about a dozen large Indiana mines involving about 3000 workers and about 20 Illinois mines affecting 1400 workers are struck. But these producers have been shipping principally to the commercial rather than industrial market. Hence, serious industrial repercussions have not resulted.

MARKING THE PATHWAY from the U. S. to the East these pyramids of Egypt, built nearly 5000 years ago, are a route marker to U. S. Army Air Transport ships.

WPB Cuts Warehouse Plate Quotas; Small Warehouses to Get Better Share

Washington

• • • **WPB has reduced** the amount of plates which can be ordered by warehouses from scheduled mill rollings in the third quarter of 1943 and the first quarter of 1944. The cuts will affect only large and seconds warehouses, while the restrictions on small warehouses having a total base tonnage of 100 tons or less for any type steel remain unchanged. The reductions are a result of the issuance of direction 2 to order M-21-b-1, effective Oct. 25.

Seconds warehouses which have been trying to increase their orders of prime quality plates, may now order from scheduled mill rollings for delivery to stock during the fourth quarter of this year or the first quarter of 1944 more than 25 per cent of the total tonnage of prime quality plates it purchased during 1940. This is reduction of 12½ per cent from the original quota of 37½ per cent.

Large warehouses having a total base tonnage of more than 100 tons for any type of steel may not order from scheduled mill rollings plates of that type for delivery to warehouse stock in the two quarters in excess of 100 per cent of its base tonnage for plates of such type. The reduction in this case is one-third of the original per cent of the base tonnage.

However, WPB officials pointed out, that these warehouses may still order their full quotas, provided that not more than the specified quantities come from scheduled rollings. It is believed that the remainder could be picked up in some cases, from mill accumulations.

WPB said this direction was issued to modify the order so that the available supply of plates may be shared equitably among all warehouses. The modification applies only to plates. Each warehouse handling plates must immediately review all its plate orders placed for delivery prior to April 1, 1944, and take any action necessary to bring the tonnage of plates ordered from scheduled rollings into line with the direction.

U. S. Steel Reports $1.48 Net Per Share

New York

• • • **U. S. Steel Corp.** on Tuesday reported a third quarter income of $19,166,596 before dividends and after allowance for estimated federal taxes. This was equivalent to $1.48 per share on the common stock. Income for the first nine months of 1943 was $50,252,649 compared with $46,495,743 in the first nine months of 1942. Directors declared a quarterly dividend of $1.75 per share on the preferred stock payable Nov. 20, to stockholders of record, Oct. 29 and a dividend of $1.00 on the common payable Dec. 20 to stockholders of record Nov. 19.

Ore Use Higher in 9 Months of 1943

Cleveland

• • • Consumption of Lake Superior iron ore during September amounted to 7,393,158 gross tons against 7,616,801 gross tons consumed during August. Cumulative consumption for 1943 up to Oct. 1 was 66,258,382 tons, while during the same period of 1942 only 63,411,652 tons was used. Stocks at furnaces and on Lake Erie docks increased during the month from 38,571,667 gross tons to 43,839,738 tons on Oct. 1. Blast furnaces in operation that depend upon Lake Superior ore remained unchanged at 192.

Continental Reports Income for 12 Months

• • • **Continental Steel Corp.** and its subsidiaries have declared a net profit for the quarter ended Sept. 30 of $147,280. Net profit for the nine months period ended Sept. 30 was $481,618 and for the 12 months ended with that date $798,471. These figures are after deductions for federal taxes and contingencies.

Jones & Laughlin Steel Reports Lower Net Income

Pittsburgh

• • • **Jones & Laughlin Steel Corp.** reports for the quarter ended Sept. 30, a consolidated profit for the corporation and its subsidiaries of $2,249,964 after all charges, including depreciation, depletion, interest and taxes. This compares with a profit of $2,539,716 reported for the quarter ended Sept. 30, 1942.

Consolidated profit for the nine months ended Sept. 30, 1943, was $7,060,581 compared with a profit of $7,470,186 reported for the same period of 1942.

Sharon Reports Income

• • • **Sharon Steel Corp.** reports for the third quarter a net profit of $273,911 after deducting $1,168,000 in federal taxes and providing $423,911 for post-war contingencies. For the nine months ended Sept. 30, net profit was $1,209,347 after deducting a total of $4,515,000 for federal taxes and $1,169,347 as a post-war fund.

• • • September pig iron production declined slightly to 5,179,479 net tons from 5,269,835 tons the previous month, although output for September was at 99.7 per cent of capacity compared with 98 per cent in August. Ferromanganese and spiegeleisen amounted to 46,037 tons, 839 tons higher than the month before.

SEPTEMBER BLAST FURNACE PRODUCTION—NET TONS

	PIG IRON		FERRO-MANGANESE AND SPIEGEL		TOTAL		
	Current Month	Year to Date	Current Month	Year to Date	Current Month	Year to Date	Percent of Capacity Current Month
DISTRIBUTION BY DISTRICTS:							
Eastern	969,713	8,537,765	15,646	172,304	985,359	8,710,069	93.3
Pittsburgh-Youngstown	2,144,271	18,768,611	17,072	162,582	2,161,343	18,931,193	100.4
Cleveland-Detroit	524,831	4,606,783	.....	.....	524,831	4,606,783	104.4
Chicago	1,116,163	9,845,970	.....	.....	1,116,163	9,845,970	103.7
Southern	335,315	2,964,925	13,319	144,752	348,634	3,109,677	96.0
Western	89,186	697,504	.....	6,141	89,186	703,645	95.8
TOTAL	5,179,479	45,421,558	46,037	485,779	5,225,516	45,907,337	99.7

During 1942 the companies included above represented 99.8 percent of the total blast furnace production.

Annual CMP Allotments to Small Users to Be Granted by WPB Regions

Washington

• • • **Allotments** of steel, copper and aluminum to smaller manufacturers of Class B products only, will now be handled on an annual instead of a quarterly basis. WPB Operations Vice Chairman Hiland G. Batcheller told a press conference on Monday that this simplification of CMP and the reduction in the number of CMP 4B's being sent to Washington was in line with WPB's plan for decentralization and elimination of paper work.

Mr. Batcheller said the reasons which prompted this move were the efficient operation of CMP and the fact that requirements are now more clearly defined. Although 15,000 smaller manufactures will now deal with the regional offices of WPB in applying for supplementary interim applications for more materials, rather than flooding Washington with forms, Mr. Batcheller said that overall control would still be retained in Washington.

A WPB spokesman estimated that 210,000 CMP 4B's now pour into Washington annually, and that this simplification plan, HXX which would in effect create 13 "little WPB S", would reduce this number to about 30,000. This would be an 86 per cent savings of all paper coming into Washington.

The program was designed for the smaller manufacturers, who account for most of the controlled material applications, although they do not consume the major portion of these materials.

Although applications will now be handled on a regional basis complete case histories of manufacturers and their products will be retained in Washington, as well as in the district offices.

The plan was classed as a "simple bookkeeping plan" by a WPB official, with no physical transfer of materials involved.

Banks of materials, on paper, will be set up in each of the regions so that there will be enough material to hand out to the districts. Returned allotments, also on paper, will be returned to these regional banks, through the district offices, for redistribution.

Should there be a program change the WPB industry division will allot materials to manufacturers through the regional and district offices. CMP forms which are now in use will be used in carying out the plan.

It was also pointed out that there is an ODXX order in preparation which will give repair shops quotas to allow them to obtain materials without filing CMP 4B's. This would eliminate 40,000 of the applications, WPB says.

Mr. Batcheller said that, as in industry, the basic step in decentralization was to set up an operating council, and that this had been done. This council which meets every two weeks to work out problems that have come up is composed of WPB regional directors, directors of the various bureaus in Washington and division directors.

It was emphasized by Mr. Batcheller and program vice chairman J. A. Krug that the new procedures did not mean a relaxation of controls or an increase in total allotments of controlled materials. They said that some materials, notably carbon steel, are still in short supply.

The two men also said that under the new plan "thousands of manufacturers will have to file but one application, and their allotments will be extended throughout 1944, and perhaps at a later date into 1945."

"The cut-off-point" to determine whether or not an application is to be handled in the simplified manner is an allotment of carbon steel exceeding 150 tons, and comparable amounts of other controlled materials. The other tentative cut-off-points are —colon—alloy steel, 40 tons—semi-copper base alloy sheet and strip, 8000 lb.—semi-copper base alloy rod, bar and wire, 10,000 lb.—semi-copper base alloy tubing and pipe, 5000 lb.—semi-brass mill unalloyed copper products, 10,000 lb.—semi-wire mill copper products, 15,000 lb.—semi-copper and copper base alloy foundry products, 30,000 lb.—semi-aluminum in all shapes, 7000 lb.

New applications, regardless of size, will continue to come to Washington. This includes applications to produce a new product, even though the material requirements are below the "cut-off" points listed above. Criteria will be established to determine when a "small case" becomes a "large case" as a result of additional material alloted on interim applications.

CMP regulations are being revised to eliminate the necessity for about 10,000 4-B applications quarterly. Other such revisions are contemplated.

At the end of November, Messrs. Batcheller and Krug said, the officials responsible for the handling of this program in each of the regional offices will meet in Washington for a short training period designed to enable them to handle the new and more responsible assignment.

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Regional WPB to Approve Building

Washington

• • • **Outlining** further details of its program for decentralizing activities, WPB last Thursday announced that applications for beginning industrial as well as non-industrial construction where the cost of the project is $10,000 or less are to be filed with and processed by the field offices, starting Oct. 25. Applications should be filed with the regional or district office nearest the location of the project.

The authority extended to the field offices (with certain exceptions listed) also covers amendments to applications increasing the cost of a project to $10,000 or more, provided the increase is not more than 50 per cent above the original estimated cost.

However, amendments to applications which had originally been processed by WPB in Washington will not go to the field offices. This is intended to eliminate unnecessary referral of records from Washington to the field.

Until Oct. 21, the field offices had processed only applications for projects of a non-industrial nature up to a value of $10,000. Plans now being formulated contemplate increasing the authority of the field offices to process both non-industrial and industrial applications above the $10,000-level.

Price Briefs

• Amdt. 10 to MPR 246 authorizes a 20 per cent increase over the present maximum prices at all levels for the "No. 2 pitcher spout pump." (Release No. OPA-3306)

•

• Rev. Order 19 under PS 41 extends the adjustable pricing provisions on locomotive and tender steel castings and railroad specialties.

Small Order Procedure Liberalized; Warehouses Benefit on Some Products

Washington

• • • **WPB announced** last week that small order provisions for steel, contained in CMP Regulation 4, have been liberalized with respect to wire (other than wire rope and music wire), pipe, galvanized sheets, tin and terne plate, and fence posts. This liberalization is contained in CMP Regulation 4, as amended Oct. 19.

As a result of the amendment, a distributer (warehouse) may fill orders, without receiving allotments, calling for delivery to one customer during any one calendar quarter of not more than 10 tons of carbon steel and 1000 lb. of stainless steel in the above indicated product groups. Previously, distributers could deliver only 2000 lb. of carbon steel and 100 lb. of stainless steel to one customer during any one calendar quarter in the indicated controlled material forms, without receiving an allotment.

A person who places an order under the socalled "small order" provisions of CMP Regulation 4, for steel, may no longer use the form of certification provided in CMP Regulation 7. The acceptable certification, as a result of the amendment, reads as follows, or as indicated in Priorities Regulation 7:

"The undersigned hereby certifies to the distributer with whom this order is placed and to WPB, subject to the criminal penalties provided in Section 35 (A) of the United States Criminal Code, that receipt of the steel covered by this order, together with all other steel received by, or on order for delivery to, the undersigned, from all sources, during the same quarter, will not exceed the limits specified in paragraph (d) (4) of CMP Regulation No. 4."

At the same time, the amended regulation extends from seven to 15 days, the time within which persons placing telephone orders on warehouses must confirm such orders, by complying with the provisions of CMP Regulation 4. This action is taken in view of the fact that warehouses are sometimes unable to obtain confirmation of orders from large customers within the 7-day period previously allowed.

Priority Changes

L-30-c—Revised order permits increased production of cast iron skillets, kettles, dutch ovens and flat irons for household, institutional, commercial, government, export or any other use. (10-22-43)

•

L-114—Amended order removes restrictions on the use of nickel silver in spectacle type goggles. (10-22-43)

•

L-142—Amended order establishes control over the distribution of vault doors. (10-20-43)

•

L-203—Amended order brings the scheduling of electrical indicating instruments under provisions of M-293. (10-23-43)

•

L-217—Amended Sched. XI and XII exempts bituminous distributors, bituminous distributor pumps, and bituminous heating kettles manufactured for use by the Armed Services and by military forces under Lend-Lease from the conservation and standardization provisions of the original orders. (10-19-43)

•

L-314—Order establishes simplification and standardization of more than 500 types of lubrication equipment. (10-20-43)

•

M-9-c-4—Amended order changes the status of various copper articles, and tightens restrictions on copper in building fittings. (10-19-43)

•

M-81—Amended order provides controlling of packing quotas of the 1943-44 seasonal packs of citrus fruits. (10-23-43)

•

M-293—Amended order classifies as Class X products fire-tube steam boilers designed to withstand a safe working pressure in excess of 15 lb. per sq. in. which are not otherwise included in Table 8. (10-23-43)

•

M-293—Amended order gives carbon dioxide fire extinguishers scheduling classification as X and Z products in table 10. (10-23-43)

Priorities Assistance To Aid Oil Groups

Washington

• • • **The Petroleum** Administration last Thursday announced simplification of an oil-industry priorities assistance order.

The priorities assistance order (WPB P-98-b) was amended, effective Oct. 19, by WPB upon the recommendation of PAW.

PAW called attention to the following changes in the P-98-b order:

To obtain ratings on items listed on WPB's List B of Priorities Regulation 3, operators now must follow the special delivery-order filing procedure, which is explained in the text of the amended order. This requires that all delivery orders be cleared through the PAW Washington office for approval prior to placement with the supplier. Previously, ratings were obtained by filing PD-1A and other forms before placing the order with the supplier. Under the amended order, operators who drill less than 40,000 ft. a year are urged to plan their materials requirements on a quarterly basis, as do other operators under CMP.

Additional CMP Developments

• A revision of Operating Procedure No. 2, Part 1, has been issued specifying the division of authority as between industry divisions, claimant agencies and non-procuring agencies.

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• Ship chandlers will be permitted to obtain an allotment of controlled materials for sale to ship operators for MRO supplies. (Release No. CMPL-474)

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• Producers and fabricators of aluminum wrought products and powders will hereafter be required to file fewer reports on authorized orders accepted for delivery. (Release No. CMPL-470)

•

• Dir. 13 to Reg. 2 provides that no user of controlled material shall accept delivery of any segment or expander steel for use in the production of piston rings if his inventory of such item is or will by virtue of such acceptance become greater than the quantity of such item he will be required to put into use during the succeeding 90-day period in order to carry out his authorized operations.

•

• Dir. 34 to Reg. 1, as amended, makes it possible for purchasers to file applications with local WPB offices for permission to acquire Class A facilities not related to construction.

•

• A revision of Reg. 4 makes changes in the warehouse regulation as it applies to small orders for steel to conform with Reg. 1 which has been revised to cover small order business.

•

Auto Parts Rating Use Affected by CMP Ruling

Washington

• • • **The WPB in Directive 5** to CMP Regulation 3, has told producers of certain automotive replacement parts that they must not use preference ratings assigned to their authorized production schedules covering such parts to buy replacement parts for resale as such. This rule, WPB pointed out, does not apply to replacement parts which will be incorporated in other replacement parts to be made by the purchasing producer, but is a limitation on purchase of such parts by producers to round out a line. The ruling applies to automotive parts as defined in L-158.

•

WPB Corrects Direction

• • • **Application for authority** to purchase Class A facilities under Direction Number 34 to CMP Regulation 1, must be filed with the local WPB Offices rather than with the WPB, Washington, according to Amendment No. 1 to that direction, announced last week.

Flat Rolled Products Subdued by Demand for Plates; Rebound to Come

o o o

• • • **The position** of flat rolled steel products has not changed much since 1939, compared with total finished steel production for sale, but there have been substantial changes in trend within the flat rolled category itself. Reflecting the tremendous shipbuilding program, necessary to transport men and materials abroad, the most substantial change in the flat rolled picture has been in the marked increase of plate production.

An analysis of flat rolled statistics shows that in 1939 flat rolled items produced for sale constituted 46.5 per cent of total finished steel products. So far in 1943, flat rolled products constituted about 43.3 per cent of total finished steel production for sale. Incidentally, flat rolled steel production this year will be about 65 per cent greater than in 1939.

As expected, the major change in the product trends within the flat rolled steel category occurred in plates, which, in 1939, were about 17.3 per cent of the total flat rolled production, but in the first eight months of 1943 had climbed to the point where they were 47.6 per cent of total flat rolled production.

Compared with total finished steel production as a whole, plate output for sale in 1939 was only 8 per cent of total finished steel products for sale, but so far this year it accounted for 20.7 per cent of total finished steel products for sale. Reflecting the gigantic conversion of strip mills to plate output, production figures for the first 8 months of this year indicate that steel plates produced for sale in 1943 will top 1939 production by about 355 per cent or more.

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At the plate kick-off table, also showing piling racks and plate stacking beds.

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The heavy inroads made by plates on the nation's continuous mills, since the war started, have resulted in a falling off of sheet output relative to the total flat rolled picture. In 1939, sheet production represented about 52.5 per cent of total flat rolled steel output, but for the first eight months of this year its participation had dropped to 31.5 per cent.

Compared with total finished steel products, sheets in 1939 accounted for 24.4 per cent of this total, but in the first eight months of this year had slipped to about 13.6 per cent. Sheet output this year probably will be about the same as in 1939 but only about two-thirds of 1941 production, when automobile production was still existent. The demand for sheets in the railroad and war picture, however, has prevented a more substantial drop than would have occurred had this demand not been present.

It is expected that sheets will gain practically all of the lost ground in the postwar era. They have been cut back sharply in recent months because of the necessity for increased plate production. Next year, when some of the pressure may be off plates because of new units, sheet expansion may expand moderately.

Portraying the need for additional space on continuous mills for plates and sheets, tin plate output also has dropped in relation to its participation in the flat rolled picture. Tin mill products in 1939 constituted about 17.4 per cent of total flat rolled items produced for sale, and this year they are expected to constitute slightly less

TRENDS IN FLAT ROLLED STEEL PRODUCED FOR SALE

1939-1943. 000 Omitted.

(Source: American Iron & Steel Institute. Net Figures Used. Adjusted for Shipments Within the Industry)

NET TONS

Year	Plates	Skelp	Sheets	Tin Mill Prod. Black P.	Tin Mill Prod. Tin Plate	Strip	TOTAL FLAT ROLLED	ALL STEEL PRODUCTS
1939	2,794	227	8,505	269	2,561	1,837	16,193	34,955
1940	4,171	527	10,186	273	2,690	2,140	19,987	45,966
1941	5,987	449	12,654	474	3,566	3,090	26,220	60,943
1942	11,437	368	8,504	419	2,659	2,234	25,621	60,591
1943 (8 Mos.)	8,461	218	5,579	206	1,500	1,785	17,749	40,913

than 10 per cent of flat rolled production.

Compared with total finished steel production, tin mill products in 1939 were 8.1 per cent of this total and in 1943 will probably be around 4 per cent. Production of tin mill products this year will probably be about 8 or 10 per cent below 1939 output, and considerably less than the 1941 production. This experience, however, is not unusual in view of the complete cessation of most peace-time uses for tin plate, not directly associated with food and war goods.

The participation of strip steel has been substantially unchanged with respect to total flat rolled products during the past five years. This is probably due to a great number of uses for strip which involve direct war products. In 1939, strip output for sale constituted 11.4 per cent of total flat rolled products, and this year it appears that strip will account for about 10 per cent of total flat rolled output. Compared with total finished steel, strip production for sale in 1939 amounted to 5.3 per cent of the total, and in the first eight months of 1943 about 4.3 per cent.

In view of the tight plate and sheet situation at present, as well as the advanced bookings of plates and sheets, which in some cases run as far as June, 1944, the trends and figures shown in this study may only change slightly next year. If anything, it is expected that for the first six months of next year, at least, plates will represent a slightly greater percentage of total flat rolled production than is indicated this year.

10 Million Affected by New English Pay-As-You-Earn Tax

• • • **England now has a "pay-as-you-earn" income tax scheme. Covering all classes of weekly wage earners whose tax is deducted in arrear, the scheme will embrace some ten million people.**

Under the scheme the weekly wage-earner will be given a code number corresponding to his tax allowances and the employer will receive a tax deduction card showing this code number. The employer puts on this card the week's pay, and from a book of tax tables supplied to him he finds, for each pay day, the amount of tax deductible from the beginning of the year up to that day. The amount of tax that is deducted is the difference between this figure and the amount already deducted in earlier weeks. If the tables show that a repayment of tax is due, the employer adds the repayment to the week's pay. However much wages fluctuate, or if the wage-earner's allowances are increased during the year, the tax deductions shown by the table will keep step with the liability each week, and "pay as you earn" is thereby achieved.

At the end of the year, the employer returns the card to the Collector of Taxes and gives the wage-earner a certificate of tax deducted. The Inspector then sends the wage-earner a statement showing the tax payable, how it is worked out, and the amount actually deducted, so that the wage-earner can check it. If there are any small adjustments they will be put right by adjusting the next year's code number or by repayment.

If a wage-earner leaves his employment the employer gives him a certificate showing the total wages to date and total tax deducted. A copy of this goes to the Inspector of Taxes. When taking on a wage-earner who has left another employment the new employer obtains from him the certificate given him by his old employer. The information on this certificate enables the new employer to make the correct weekly deductions of tax.

Once a month the employer pays over the tax deducted to the Collector of Taxes.

Hours Curtailed at Jack & Heintz

Cleveland

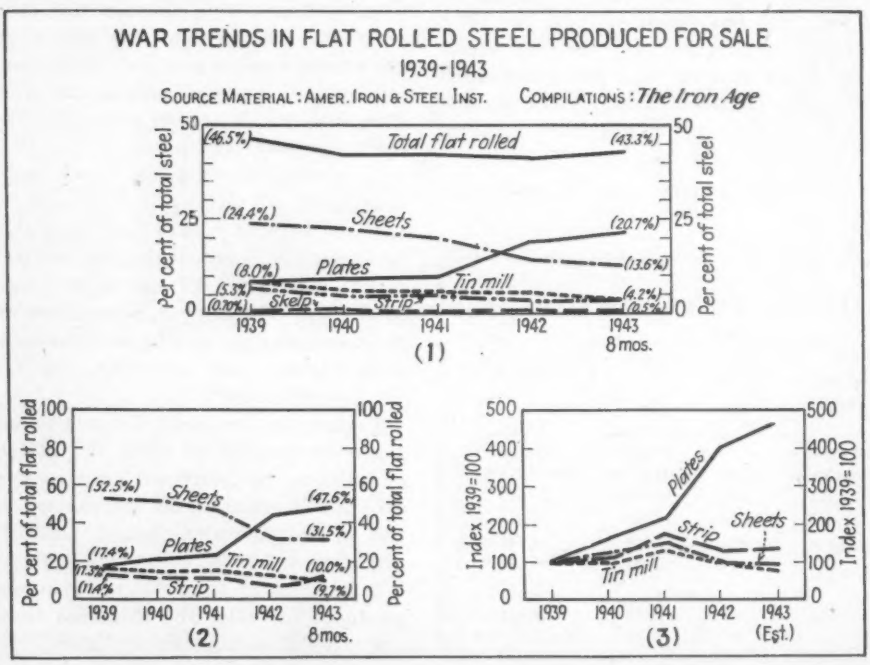
• • • Because Jack & Heintz, Inc., has been able to get ahead of schedule in production of aircraft control parts, a temporary cut in the two-shift, around-the-clock work week was announced. However, the company shortly expects a new contract for aircraft parts that will mean a 20 per cent boost in output, and at this time the company's 7000 employees will go back on the 12-hr. a day, seven days a week, work schedule.

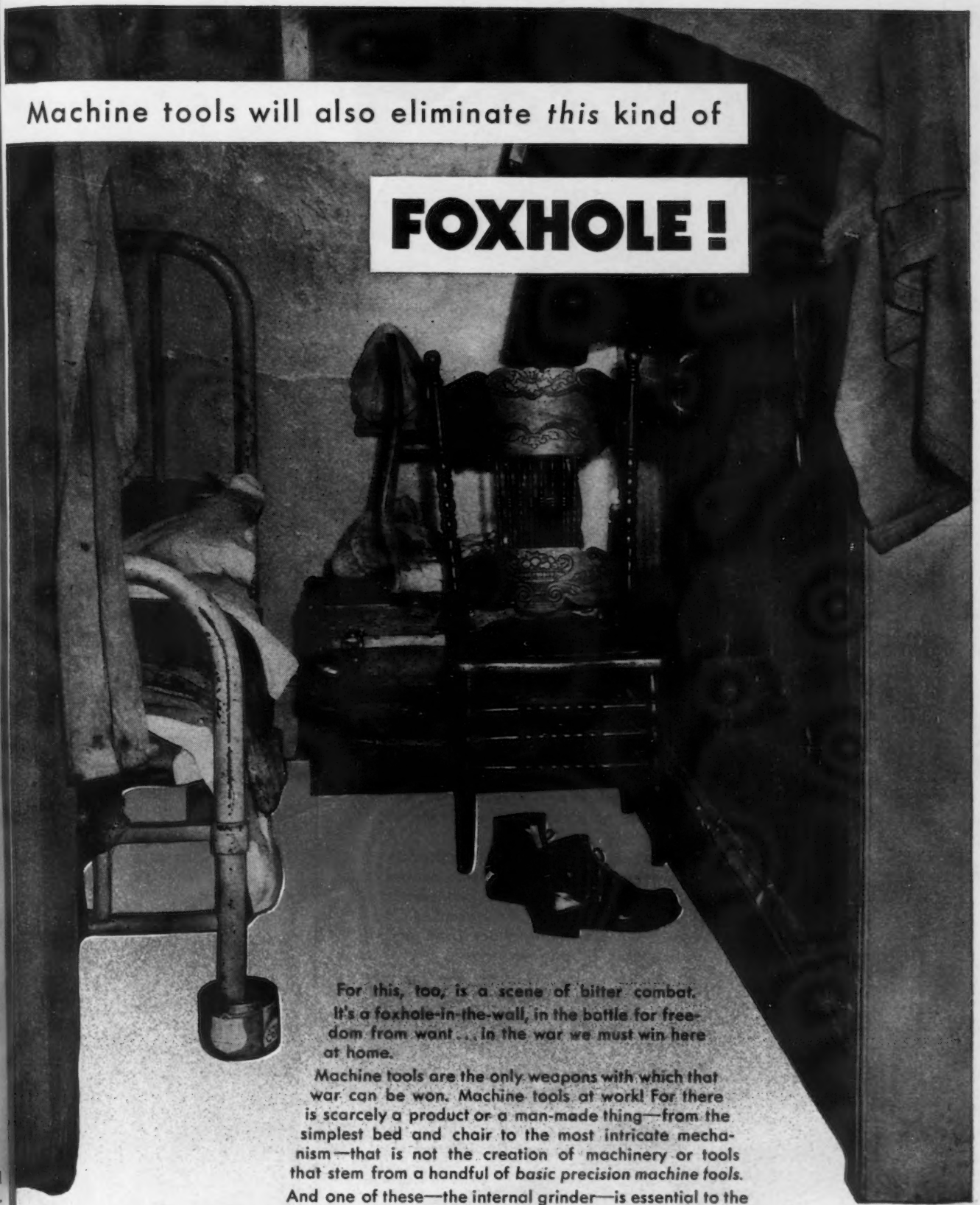
The new work plan will mean that day shift employees will work 11 instead of 12 hr. daily Mondays through Fridays; five instead of 10 hr. on Saturdays; and will not work on Sunday, as heretofore. Those employed on the night shift will work six 12-hr. shifts a week instead of seven.

Buick Scheduled to Make Engines for 25,000th Bomber

Flint, Mich.

• • • The Buick Division of General Motors Corp. was scheduled to produce its 25,000th Liberator bomber engines on Thursday, Oct. 21. These power plants are Pratt and Whitney R-1830-43 models, turning up 1200 hp. The first engine was produced in January, 1941. A statement by the company that current production aggregates 4,000,000 hp. this month would indicate that unit production is well above the 3000 mark monthly.





Machine tools will also eliminate *this* kind of

FOXHOLE!

For this, too, is a scene of bitter combat. It's a foxhole-in-the-wall, in the battle for freedom from want . . . in the war we must win here at home.

Machine tools are the only weapons with which that war can be won. Machine tools at work! For there is scarcely a product or a man-made thing—from the simplest bed and chair to the most intricate mechanism—that is not the creation of machinery or tools that stem from a handful of *basic precision machine tools.*

And one of these—the internal grinder—is essential to the creation of nearly every machine and tool that will make for a finer standard of living after this war.

It is because of this that the job ahead of us, here at Bryant, will continue to be a truly great one when the war is won. Call on us!

BRYANT CHUCKING GRINDER COMPANY Springfield, Vermont, U. S. A.

Impact of Taxes On Steel Analyzed

(CONTINUED FROM PAGE 102)

panies in this as well as the other five iron and steel groups appear in a table at the conclusion of this article.

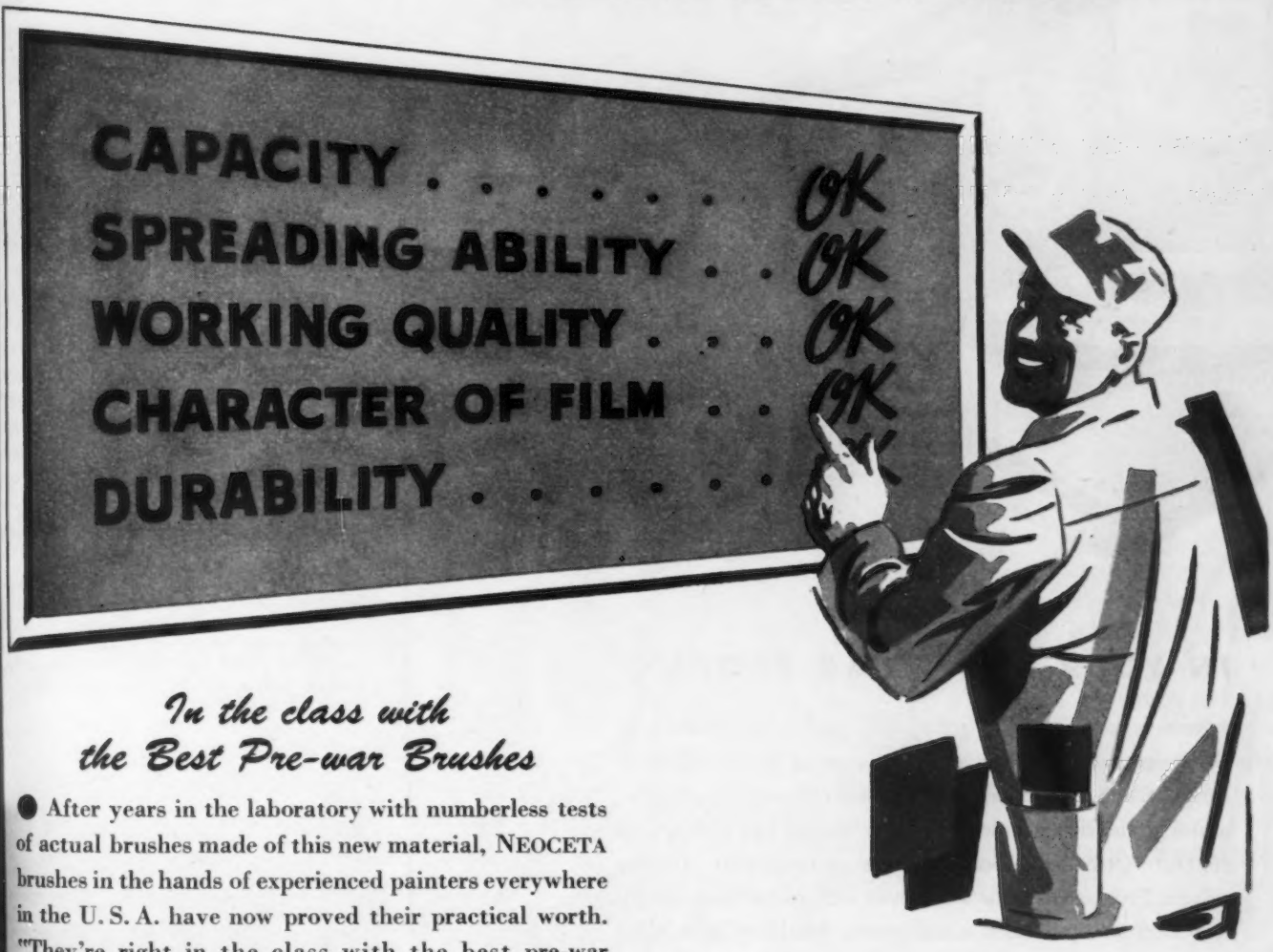
A somewhat less startling picture is to be found among the figures for the group of 12 steel producers without blast furnace facilities. Here, capital in the aggregate of $132,804,000 was found by the SEC to have been invested in 1941, as against $82,117,000 for ten companies then comprising the group in 1936.

The 12 companies in 1941 had net profit before prior claims, interest and income taxes amounting to $46,420,000, or almost exactly five times the corresponding figure for ten concerns in 1936, $8,939,000. Prior claims and interest required $172,000 in 1936 $734,000 in 1941.

Here again the tax picture is of absorbing interest. The ten companies in 1936 made provision for $1,551,000 in income taxes, or about one-sixth of the net profit before the listed charges. In 1941, the provision for income taxes for the twelve companies aggregated $27,738,000, or more than one-half of the net profit before an

CROSBY RESEARCH FOUNDATION: Crooner Bing Crosby and his brothers, Bob and Larry, have established a laboratory to test new inventions. Most of the projects are of a military nature, but a few are not. Here Lloyd Praeger, manager of the Foundation, checks a new method of window shade installation.

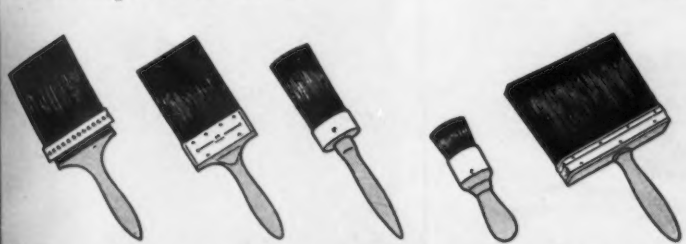
NEOCETA
SYNTHETIC BRISTLE BRUSHES



In the class with the Best Pre-war Brushes

● After years in the laboratory with numberless tests of actual brushes made of this new material, NEOCETA brushes in the hands of experienced painters everywhere in the U. S. A. have now proved their practical worth. "They're right in the class with the best pre-war brushes," painters say. Skilled painters with great war-time production schedules have found in Neoceta brushes an answer to their needs far beyond their expectation. This is the first full line of painters' tools made of synthetic bristle—an important milestone in the development of brushes.

NEOCETA brushes of various types are now available for specific "end-uses." See the nearest "Pittsburgh" branch for complete information regarding NEOCETA.



PITTSBURGH PLATE GLASS COMPANY

NEOCETA brushes are manufactured by the creators of famous *Gold Stripe* brushes

approximately 18½ times the amount paid in 1936.

In other words, as net profit before such charges was increasing five times, income taxes were soaring by 18½ times. This tremendous barrier to excessive profits limited the companies in 1941 to an amount that was 13.52 per cent of invested capital, as against 9.29 per cent in 1936.

The picture is similar in the case of the four pig iron producers, for which the Commission found invested capital of $112,092,000 in 1941 as against $111,395,000 in 1936. The net profit before prior claims, interest and income taxes in 1941 was $11,334,000, or about 2.4 times as great as the corresponding figure of $4,879,000 in 1936.

Prior claims and interest here were cut almost to one-third the 1936 amount of $1,744,000. In 1941 it was $628,000.

The provision for income taxes in 1936 was $607,000, or approximately one-eighth of the net profit before prior claims, interest and income taxes. In 1941, however, the provision for income taxes was $5,008,000, or

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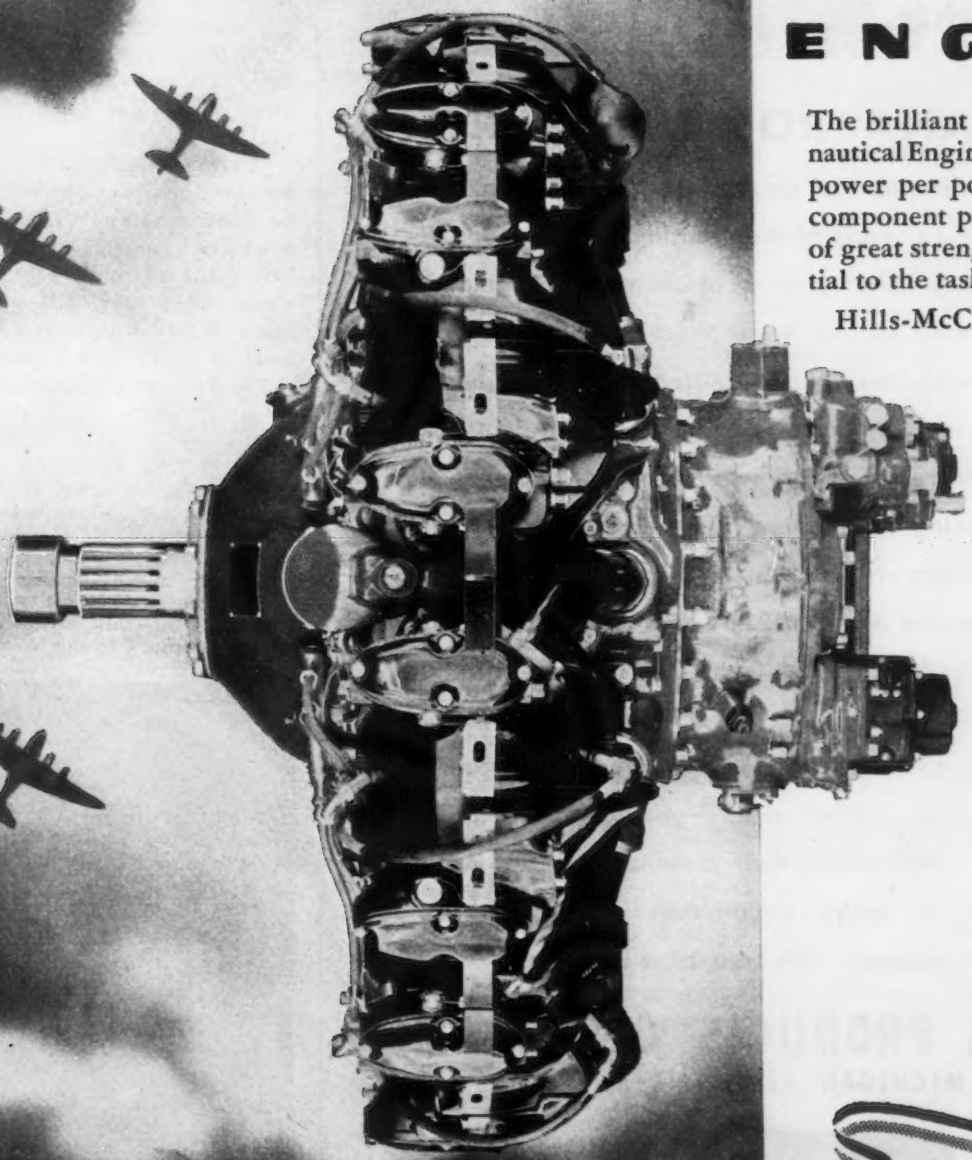
COVETED HONOR: Col. A. C. Rasmussen, left, presented the Auxiliary Military Police Guidon designating excellence in plant security to Chief Emil Gau for the company guard force of the Cincinnati Milling Machine Co.

HILLS-McCANNA MAGNESIUM ALLOY SAND CASTINGS

PLAY AN IMPORTANT ROLE IN THE PRODUCTION OF *Wright* ENGINES



The brilliant Wright "Cyclone" Aeronautical Engine, designed for maximum power per pound of weight, requires component parts necessarily light, yet of great strength and endurance essential to the task.

Hills-McCanna Magnesium Alloy Sand Castings contribute this rare combination of qualities to the efficiency of Wright Engines through highly advantageous application.

Our expert engineers, fortified with years of intensive experience with these castings can be of valuable assistance to you in your consideration of post-war plans and products.

HILLS-McCANNA CO.
3017 N. WESTERN AVE. - CHICAGO

PROPORTIONING PUMPS - AIR & WATER VALVES - CHEMICAL VALVES
MARINE VALVES - FORCE-FEED LUBRICATORS - BONNETAL CASTINGS

almost one-half of net profit before and no less than approximately 8 1/3 times as much as in 1936, although net profit before had increased by only 2.4 times. The final net profit in 1941 was 5.08 per cent of invested capital, as against 4.43 in 1940, 1.38 in 1939, 0.26 in 1938, 5.16 in 1937, and 2.27 in 1936.

Among the 17 producers of miscellaneous iron and steel products the Commission found capital invested in the aggregate of $72,231,000 in 1941, and in the aggregate of $45,577,000 in 1936, when there were only 14 companies in the group.

Repeating the tax story, net profit before the usual deductions in 1936 was $6,812,000, in 1941 $26,860,000, or 3.9 times as much as the earlier year. Prior claims and interest drained away $836,000 in 1936, $1,391,000 in 1941.

Tax-wise, the picture is this: 1936, $986,000, or about one-seventh of the net profit before; 1941, $14,154,000, or more than one-half of the net profit before and approximately 14 times as much as in 1936, although the net profit before was only 3.9 times as much as in the earlier year.

The final net profit here in 1941 was

THIRTEEN IN ONE: This machine executes a "pincers movement" in punching 13 holes at one time in the plastic helmets which Westinghouse Electric is making for the Army. The holes are pierced to allow for riveting of chin strap, neck band and hammock to the helmet.

15.67 per cent of invested capital, as against 10.94 in 1936, 12.15 in 1937, 0.43 in 1938, 7.93 in 1939, 9.79 in 1940.

The 10 producers of iron and steel foundry products had invested capital, the SEC found, of $71,257,000, a relatively slight increase over the $66,531,000 reported for the same number in 1936. Net profit before in 1941 was $14,068,000, or 3.1 times as much as the $4,440,000 of 1936. Prior claims and interest took $583,000 in 1936, $325,000 in 1941.

The companies here provided $624,000 in 1936 for income taxes, or one-seventh of the net profit before. In 1941, they provided $6,512,000, or nearly one-half of the net profit before and nearly eleven times as much as in 1936, although the net profit before had increased by only 3.1 times.

The final net profit in 1941 was 10.15 per cent of invested capital as against 7.01 in 1940, 6.29 in 1939, 1.08 in 1938, 6.74 in 1937, and 4.64 in 1936.

In the sixth and smallest group, the SEC found the five rolling mills without steel making facilities to have had invested capital in the aggregate of $27,704,000 in 1941, as against $23,054,000 for the same concerns in 1936.

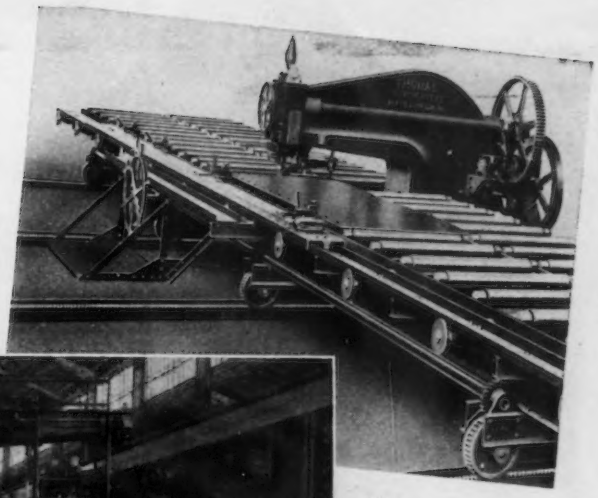
The net profit before in 1941 was $15,361,000, or 3.1 times as great as the figure of $4,957,000 for 1936. Prior claims and interest took $199,000 in 1936 and $170,000 in 1941.

The provision for income taxes totaled $925,000 in 1936, or about one-fifth of net profit before. In 1941, the same companies provided $9,300,000 for income taxes.

GENIUSES: Chatting together at the presentation ceremonies of the first helicopter to the museum in Greenfield Village are Henry Ford and Igor Sikorsky, inventor of the helicopter.

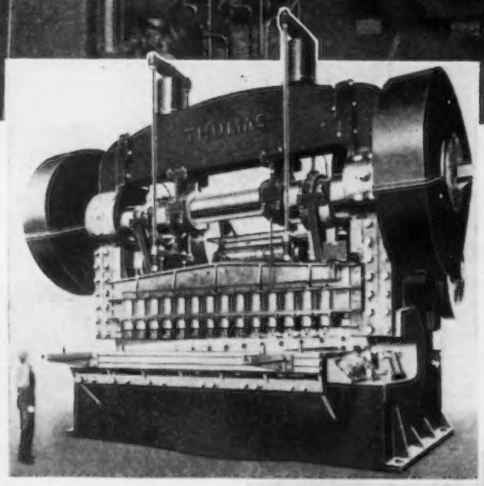
THOMAS

can help meet your production needs!

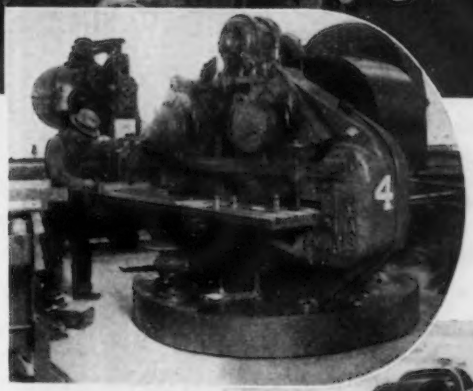


Above
Thomas High Precision Plate Punch and Table for punching ship, tank, boiler, car and various kinds of plates.

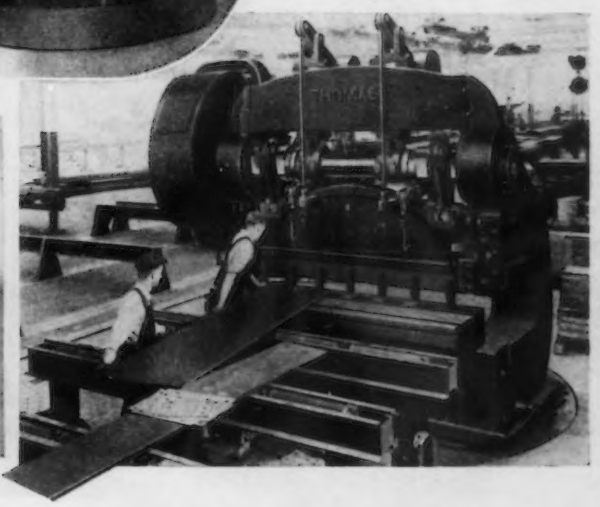
View of central aisle, in main plant.



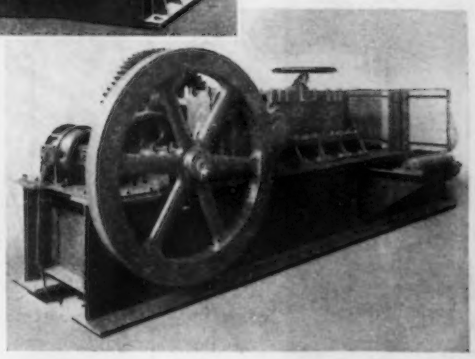
At left
Angle Shear.



Below
Thomas Shears. Built with capacities up to 3 inches in thickness and widths up to 14 ft. or more.



Above
Heavy Duty Plate Shear.



At right
Bending and Straightening Machines.

WHETHER it's punching and shearing equipment, or other types of production machinery and fabricating equipment, THOMAS specialization and skill is at your command.

If special machinery is required, Thomas can meet your problems with equal efficiency. Ask for further information; let us estimate on your requirements.

THOMAS
MACHINE MANUFACTURING COMPANY
PITTSBURGH, PA.

Treasury Believes Refunds Sufficient

(CONTINUED FROM PAGE 103)

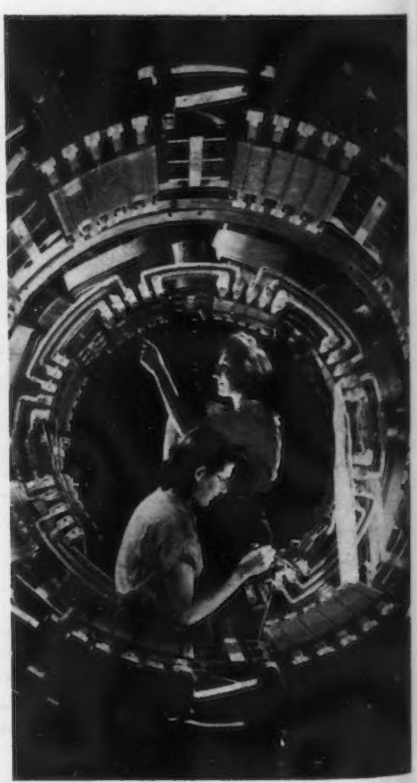
against income earned in the two preceding years. However, losses cannot be offset against income earned in a taxable year beginning before Jan. 1, 1941.

Income of the first of these years must be fully offset before income in the second may be reduced; excess profits in each year are offset before normal profits. Similarly, if income earned in any one year falls below the taxpayer's excess profits credit, the unused portion of the excess profits credit is applied against excess profits earned in the two preceding years. The effect of the provision is to increase the total excess profits credit of the two preceding years by this unused portion.

The operation of these provisions was illustrated by the Treasury by means of the accompanying tables, one on the net operating loss carry-back, the others on the unused excess profits credit carry-back.

If a corporation, not subject to the

BUILDING POWER: Almost one-fifth of a mile of tape must be wound by hand to insulate these stators for two large electric motors being built by Westinghouse Electric for the Navy.



Official U. S. Army Signal Corps Photo

THERE'S A *New* HEAVY WEAPON ON THE CUTTING LINES, TOO - IT'S *Super DBL* HIGH SPEED STEEL

Available

IN THESE FORMS

★ Hot Rolled and Forged Bars in all necessary sizes.

★ Ground Bars: rounds in sizes up to 3" dia.—polished, standard ground or rough ground finishes.

★ Hardened and Tempered Tool-Holder Bits in sizes from 3/16" to 1", packed in one or assorted sizes as needed. Also special sizes as may be required.

NOTHING NEW TO LEARN IN HEAT TREATMENT OR SHOP HANDLING

IN the M-12 Tank Destroyer, above, Army Ordnance has combined the great hitting power and range of the 155 mm gun with the speed and mobility of the medium tank chassis. The result is a weapon that not only can stop any enemy tank now or likely to be in the field, but can blast out land strong-points or sink a ship.

In similar fashion, Allegheny Ludlum technicians have added cobalt to the familiar AL-developed DBL low-tungsten moly analysis. The result, *Super DBL,* is a high speed steel of maximum red hardness for heavy duty work—a material that delivers top performance at the same time that it conserves strategic materials.

Super DBL has been thoroughly proved in service. Use it for your heavy roughing and "hogging" jobs—it's suitable for anything from hard, gritty materials to tough, heat-treated alloy steels. ● Full information is available in the *"Super DBL* Blue Sheet." Write for your copy, or for the assistance of our Mill Service Staff in selecting the proper grades of AL Tool Steels for your various production jobs.

ADDRESS DEPT. IA-11

Allegheny Ludlum
STEEL CORPORATION
BRACKENRIDGE, PENNSYLVANIA

A-9075 ... W & D

excess profits tax has the following net income in 1943 to 1947 and is subject to a 40 per cent tax, the loss carry-back would make the following adjustment:

Year	Net Income	Tax Payments	Tax Refunds
1943	$100,000	$40,000	.....
1944	100,000	40,000	.....
1945	—50,000	.....	$20,000[1]
1946	—50,000	.....	20,000[2]
Total	$100,000	$80,000	$40,000

[1] Of 1943 taxes.
[2] Of 1944 taxes.

The loss of 1945, assuming a cutoff of war orders, etc., is carried back as a deduction from income earned in 1943, reducing the latter to $50,000 and resulting in a tax refund of $20,000. The loss in 1946 is deducted from 1944 income and also results in a refund of $20,000. Thus, for the entire period the taxpayer earned but $100,000 and was taxed at the statutory rate of $40,000. In the absence of the carry-back provision, the taxes paid for the four-year period would have been $80,000.

The carry-back of unused excess profits credit was illustrated by the following table:

Year	Total Net Income	Excess Profits Credit	Adjusted Excess Profits Net Income	Unused Excess Profits Credit	Normal and Surtax Net Income
1943	$1,800	$1,000	$800	....	$1,000
1944	700	1,000	....	$300	700
Total	$2,500	$2,000	$800	$300	$1,700

The 1944 net income falls below the firm's excess profits credit, resulting in a carry-back of the unused excess profits credit of $300. Giving effect to this carry-back, the above illustration as finally adjusted is as follows:

Year	Total Net Income	Excess Profits Credit	Adjusted Excess Profits Net Income	Normal and Surtax Net Income
1943	$1,800	$1,300	$500	$1,300
1944	700	700	....	700
Total	$2,500	$2,000	$500	$2,000

Income of $300, previously taxed as excess-profits, is changed into normal profits. In the absence of the adjustment the firm would have paid $648 in excess profits taxes ($800 x 81 per cent) and $680 in normal and surtaxes ($1,700 x 40 per cent). After the carry-back adjustment the firm is liable for only $405 in excess profits taxes ($500 x 81 per cent) and $800 in normal and surtaxes ($2,000 x 40 per cent). The carry-back, therefore, re-

BREECH BLOCKS AND HOUSINGS OF *Barium Steel* PROVIDE THE KICK OFF

Barium Alloy Steel again demonstrates its ability to handle tough assignments.

For the Breech Blocks and Housings of many of the guns in Uncle Sam's Navy are products of Barium's *Unified Control:*

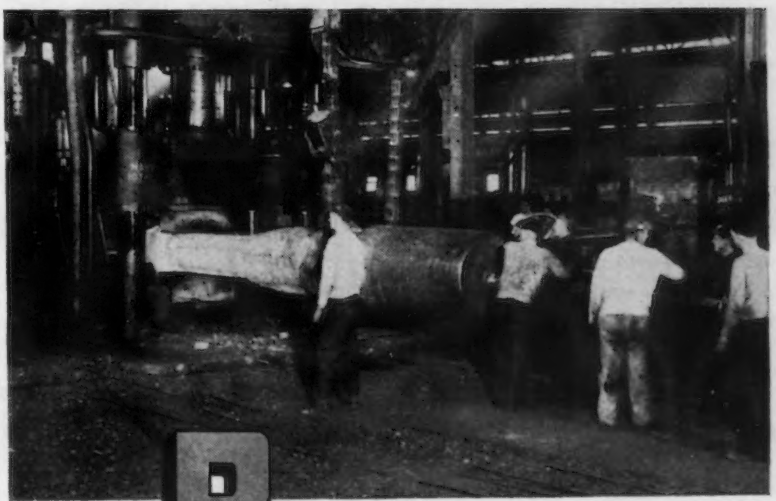
Melted and refined in Barium's furnaces

Forged under Barium's giant presses and hammers

Scientifically heat treated and quenched

Machined in Barium shops

It is *team-work* like this that accounts for Barium success in furnishing hard-to-make ordnance. We invite your inquiries for Die Blocks, Hammer Rods and Heavy Forgings.



BARIUM

STAINLESS STEEL CORP.

CANTON • OHIO

Producers of Stainless, Alloy, and Carbon Steels

sults in a tax refund of $123. The effect of the deduction has been to average the excess profits for the period the tax is in effect.

Continuing, the Treasury statement indicates that the two-year limitation on the carry-back might be inadequate in some cases. This limitation means that net income in the two preceding years must absorb post-war losses.

Although the remainder of losses which are not absorbed by the preceding year's income may be offset against income earned in the two succeeding years, tax rates on this latter income will presumably have been reduced from wartime levels. On the other hand, all that a satisfactory adjustment requires is that the portion of post-war losses represented by post-war costs directly related to wartime income be deducted from income earned in the two years preceding the loss. Any part of post-war losses that is not directly related to wartime income has no direct claim as a deduction from such income.

Even if the amount of income earned in the two preceding years is adequate for complete absorption of post-war losses, a theoretically correct apportionment would require the deduction of post-war cost directly related to wartime income from all the years in which such income was earned, Treasury officials pointed out. Since tax rates have increased since the inception of the defense program, the two-year limitation on carry-backs may result in larger refunds than would have resulted from a theoretically correct collection of post-war costs.

The two-year limitation may, therefore, make more than or less than the proper adjustment for post-war costs, when it permits their deduction from income earned during the war.

Where post-war costs are incurred within two years after the war's end, some appraisal can be made of the adequacy of the income of the two preceding years for absorbing these costs and losses. Estimated net income of corporations as a group in 1942 and 1943 and the losses which they should be able to absorb is presented below:

Year	All Corporations Net Income Before Taxes[1]	All Corporations Estimated Base for Carry-backs[2]	Net Income Corporations Net Income Before Taxes[1]	Net Income Corporations Estimated Base for Carry-backs[2]
1941 ...	$14.3	$13.5	$16.0	$15.5
1942 ...	20.1	19.3	21.1	20.5
1943 ...	22.2	21.4	23.6	23.0

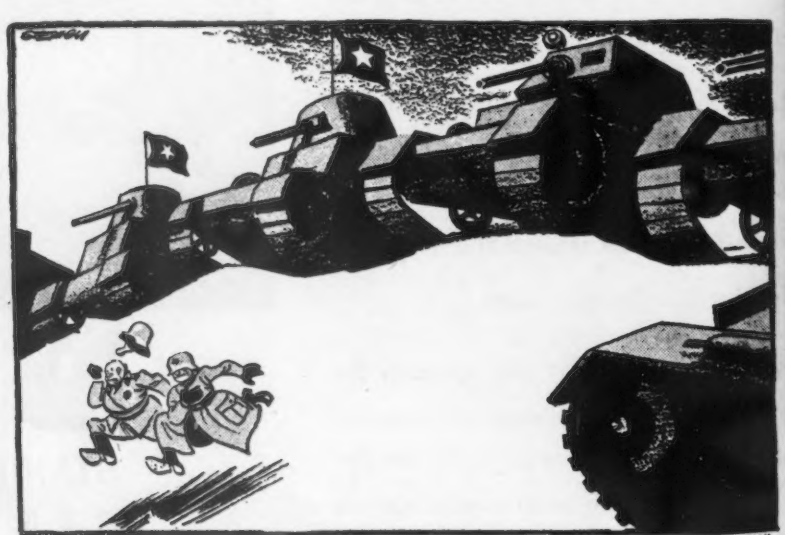
(In billions.)

[1] Excluding dividends received from domestic corporations.

[2] Excluding dividends received from domestic corporations and tax-exempt interest.

If all net income corporations are considered as a unit, estimated net income before taxes in 1942 and 1943 of $43,500,000,000 would be chargeable with losses incurred in 1944, if the war ended in that year. Even if the losses were not incurred until 1945, income in 1943 alone should be able to absorb losses of $23,000,000,000.

Some idea of the enormous amount of losses that net income in 1942 and 1943 can absorb may be gained by comparison with several other figures, the Treasury Department said. For example, aggregate corporate deficits in the worst year of this country's recent economic history, 1932, were $7,800,000,000; complete write-off of



"The Fuehrer calls this a strategic retreat!"

CONTINENTAL Rolls...

TOUGH AS A MARINE
TEMPERED FOR ACTION

THE ability "to take it"—even under pressure—which has earned for the United States Marine the reputation for being an invincible fighter, has won Continental Cromonite Rolls a reputation as well. A reputation for speeding plate and strip steel production for tanks, ships, planes and scores of other uses.

Pioneered by Continental, Cromonite hard alloy chill rolls are today the choice of steel mills where uniform, satin-smooth, scale-tight finishes are required.

They last longer—stand up under the most severe high-speed operation.

CONTINENTAL ROLL & STEEL FOUNDRY COMPANY
CHICAGO • PITTSBURGH

CROMONITE ROLLS

For custom built Rolls, Rolling Mill Equipment, Carbon and Alloy Steel Castings and special machinery of many types consult Continental.

CONTINENTAL ROLL & STEEL FOUNDRY COMPANY

Now — and in 194-?

"We have no illusions about the job ahead — after the war is won. Then, we've got to win the peace; keep production up; keep men employed building more goods for more people at lower cost.

"We bought P&H Electric Cranes with this in mind. For we know how much depends upon the swift, efficient handling of heavy materials — both now and in the years ahead."

P&H
OVERHEAD CRANES

P&H is America's largest and only crane builder producing complete electrical crane equipment.

ARMY E NAVY

A new star has been added to P&H's award for excellence in war production.

General Offices: 4401 W. National Avenue, Milwaukee, Wisconsin

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If you operate magnetic separators, this bulletin will aid you in securing better performance from them. Completely illustrated, it covers such subjects as: Magnetism; Electromagnets; Mechanical and Electrical Maintenance; Repairs; Pulley Operating Speeds; Trouble Shooting; Installation Practice; Pulley Selection and Capacities; etc. Tells where and when not to use magnetic pulleys, describes testing procedure, explains how to minimize chance of coils burning out, explains electromagnetism. A valuable, useful guide to separator operation containing material never before written on the subject and data never before compiled under one cover.

Your copy may be secured by writing to Dings.

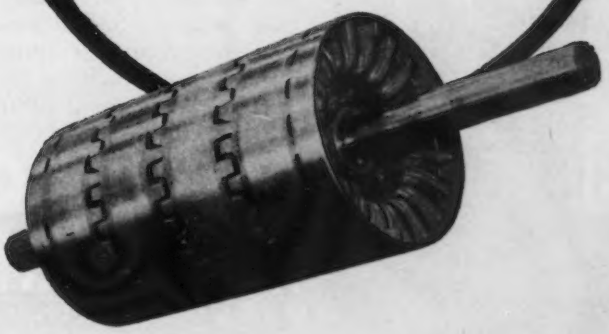
DINGS MAGNETIC SEPARATOR CO.
516 E. Smith St. • Milwaukee 7, Wisconsin
Separation Headquarters Since 1899

Dings MAGNETIC SEPARATION HIGH INTENSITY

THE DINGS MAGNETIC PULLEY

. . . Most Powerful Size for Size!

Dings Pulleys assure you maximum separating ability because: Air-cooling dissipates heat that would reduce magnetic pull; and non-magnetic bronze coil covers do not "short-circuit" or weaken magnetic lines of force. Remember these features and submit your separation problems to Dings.



all business inventories, at the end of May, 1943, would equal $27,200,000,000; and if six months' wages were paid to all workers in the commodity-producing industries, this would equal $23,900,000,000 at the rate of payment in June, 1943. The Treasury bases these figures on some of their studies, as well as those of the Department of Commerce.

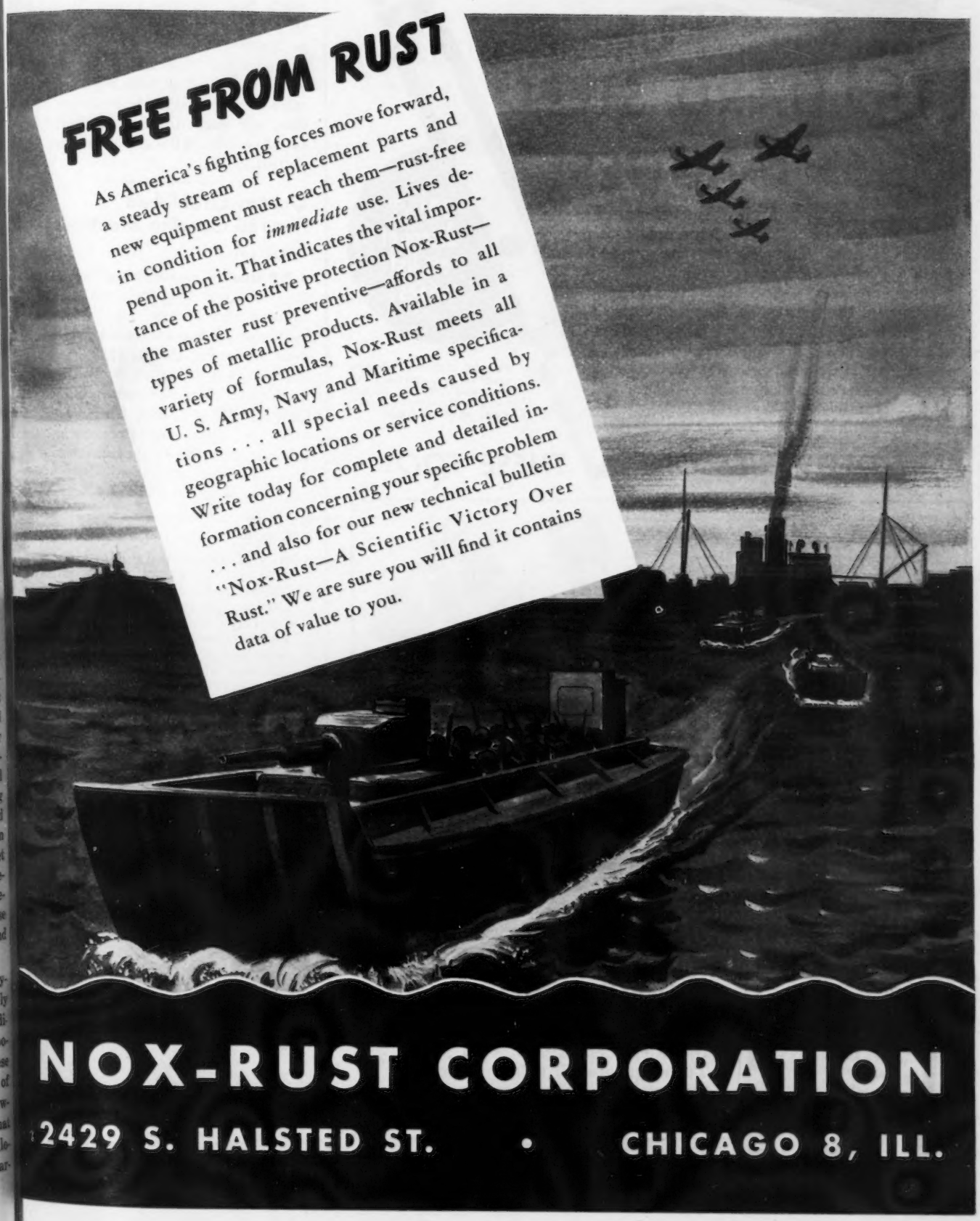
It appears evident from the Treasury's study that even under quite pessimistic assumptions, wartime income of corporations in the aggregate is sufficient to absorb most of the conceivable post-war losses if they occurred in the first two years after the war. However, cases of individual corporations vary greatly and data for a few corporations is presented in the following table.

Companies were selected by the Treasury as illustrative of those which will have a severe problem to meet either because of inventory losses, reconversion costs, differed maintenance, dismissal compensation, or loss of post-war markets. The approximate base for carry-backs is 1942 plus 1943 income, assuming that the net income before taxes will be the same as in 1942. Income for these two years is then compared with 1942 inventories, 1942 net plant, 1942 cost of sales, the estimated amount of dismissal compensation if all employees in 1942 in excess of those employed in 1939 were paid $150, and the estimates of post-war losses the companies themselves have made in their accounts.

If the companies' estimates of post-war costs as shown by reserve deductions are taken as a criterion, net income earned in 1942 and estimated net income in 1943 will easily bear them. In three of the cases, net income of the two preceding years could absorb substantially all operating costs of 1942; that is, production could be carried on at a very high rate in 1942 and the product given away, yet the carry-back would result in refunds of from two-thirds to three-fourths of the resultant losses. These three are in the heavy machinery and machine tool group.

It is apparent, therefore, that carry-backs should be able to adequately absorb postwar losses for most individual corporations as well as corporations in the aggregate, if these losses occur shortly after the end of the war. This does not imply, however, according to the Treasury, that the carry-backs will necessarily allocate all post-war costs against wartime income.

VITAL WAR GOODS MUST BE DELIVERED



WPB Issues New Rules on Appeals from L and M Orders

Washington

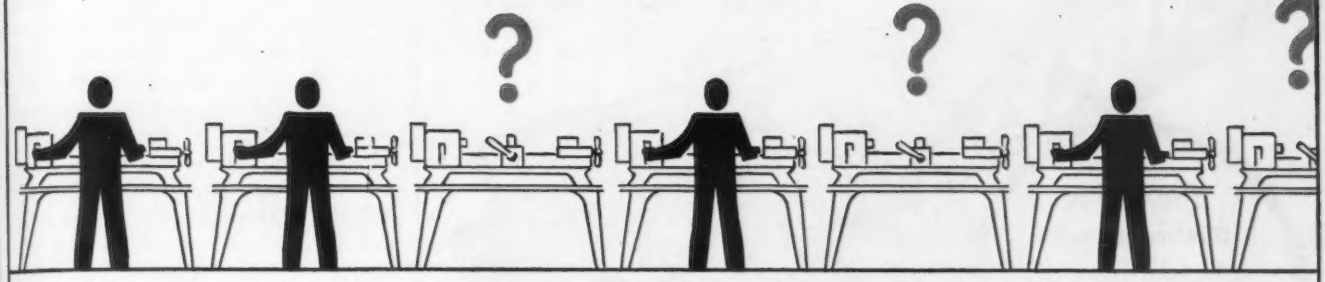
• • • **WPB** issued a revision of Priorities Regulation 16, governing the filing, granting and denial of appeals from various L and M orders. Of principal interest to manufacturers is the new List A to the regulation, enumerating orders from which appeals must be filed with WPB regional offices. This list now includes more than 180 such orders and is further evidence of WPB's continuing decentralization.

Quotas Established For 150 Canning Machines

Washington

• • • **Quotas establishing** the quantities of over 150 specified types of canning machinery and equipment that may be manufactured during the year beginning Oct. 1, 1943, were announced last Saturday by WPB. Action was taken through issuance of Schedule III of L-292. The order provides for schedules prescribing the number of units of various kinds of food processing machinery which may be manufactured by any producer.

ORGANIZER: Claud S. Gordon, president of the Claud S. Gordon Co., Chicago, is the god-father of a unique sports event, Chicago Industrial Amateur Golf Tournament. Two hundred golfers of fifty teams represented approximately one million war plant workers participated this year.



Let's "air" some of your manpower problems

When manpower difficulties are analyzed, two factors generally appear as major problems: getting replacements with the necessary *strength* to handle heavy work and *training* green employees to the point where they can be trusted to handle expensive and complex equipment.

If you have problems like these, the chances are excellent that Westinghouse Remote Control Equipment can help you.

The small W·A·B control handle moves at a finger-touch, and produces a precise response from the operating mechanism. The *force* exerted by the operating mechanism can be exactly adjusted to the job—anything from an ounce to tons.

Control of a whole series of operations can be concentrated in one handle. It is impossible for an inexperienced operator to alter the cycle, and damage the machine. And interlocks can be easily provided to further compensate for any lack of skill or judgment.

W·A·B Remote Control Systems are already installed and successfully operating on production equipment, conveyors, cranes, hoists, shovels, and ships. But current uses have merely scratched the surface of their possibilities.

Somewhere in your plant, or in the products you manufacture, there is a place for W·A·B Remote Control Systems. It may be that "off the shelf" W·A·B devices can do the job. One of our representatives will be glad to talk things over with you. Write, wire or phone.

Westinghouse Air Brake Company

INDUSTRIAL DIVISION

General Offices: Wilmerding, Pa.

74 Years of Pneumatic Control Experience

W·A·B

Pneumatic • Pneumatic-Electric • Pneumatic-Hydraulic

control systems

Simplified Practices to Aid Marine Hardware Output

Washington

• • • **Effective Nov. 14, WPB** simplified practices affecting the sizes and types of certain items of marine fittings hardware and materials used in their manufacture were established by Schedule III of Order L-236 issued Oct. 14. Items covered by the schedule, with specifications set forth in Tables I through VII respectively, are: forged, fabricated and pipe turnbuckles; forged shackles; rope thimbles; forged rope sockets; forged hoist and grab hooks; cleats; and clocks. It is anticipated that the provisions of the schedule will result in increased production.

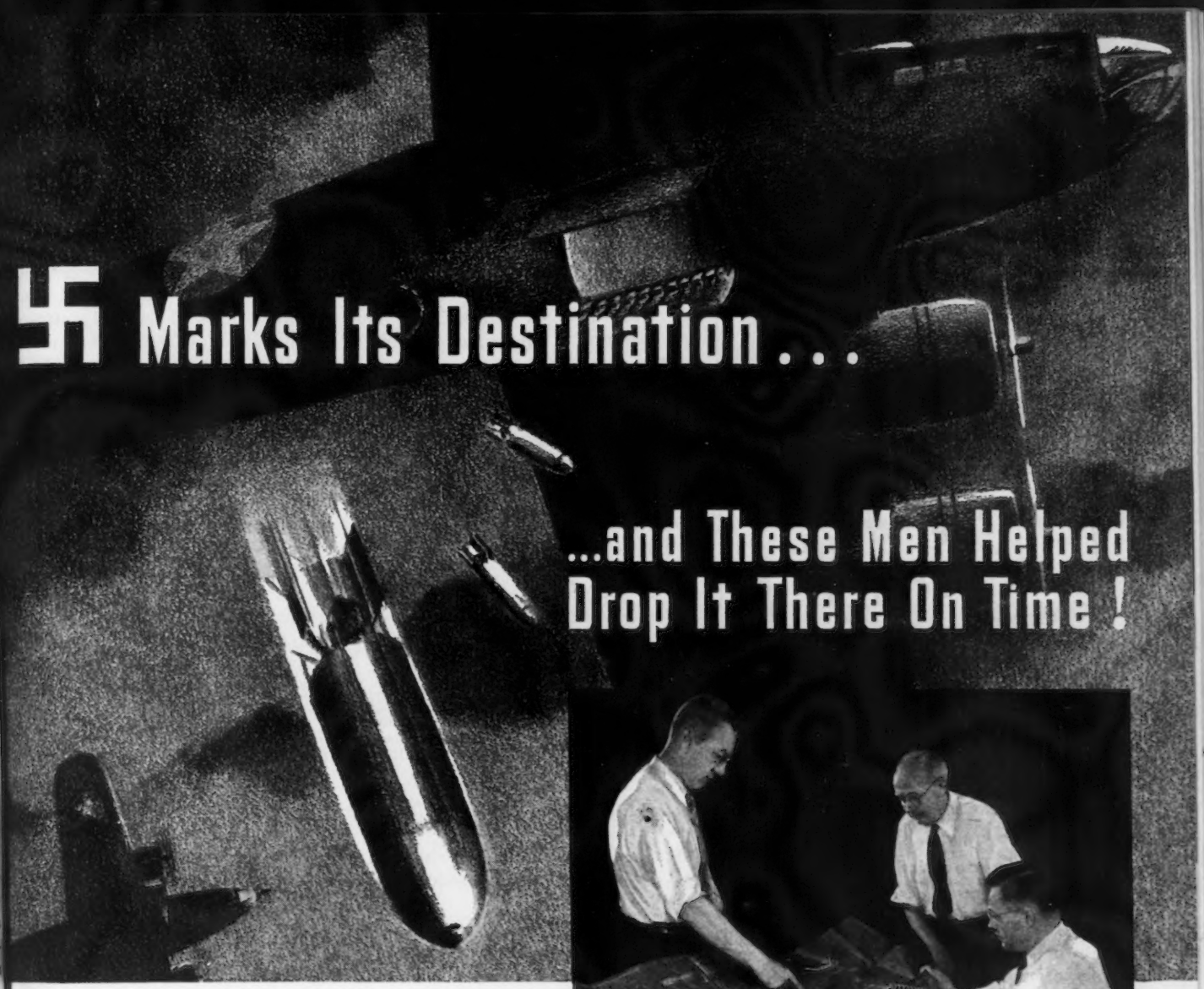
•

Z Component Scheduling Granted to Canadians

Washington

• • • **WPB last Thursday** announced that Class Z product scheduling provisions of Order M-293 have been made available to essential Canadian war programs. The Class Z product scheduling procedures are applicable to Canadian programs which correspond to United States programs listed in Table I of General Scheduling Order M-293, as a result of an amendment to table, issued Oct. 13.

MINIATURE ASSEMBLY LINE: A worker at Westinghouse Meter Division assembles the intricate mechanism that goes into each combat instrument.



卐 Marks Its Destination . . .

. . . and These Men Helped Drop It There On Time !

Cutting Tool Industry Performs Near-Miracles Under Test of War . . . . .

An American bomber is over the target. Suddenly the crew sings out "Bombs away!" Far below, a railway junction thunders into shattering bits. This bombing crew's job is done for today.

Building bombers, building block-busters and many other war weapons calls for plenty of *metal-cutting tools.* Most of these cutting tools were not even in existence a few months ago. But engineering craftsmen of the cutting tool industry met this challenge. And they take a modest pride in the efficient manner in which their job has been done.

By way of illustration, cutting tools for the production of a certain aircraft engine part formerly entailed a complicated grinding operation — in order to achieve the correct accuracy and finish.

Engineers (like those pictured above) got busy, came through with an *unground* cutter, accurate in form to within 2½/10,000ths of an inch, that produced smoothly finished parts. Production zoomed. Vital time was saved. Planes got in the air faster!

Under the test of war, Barber-Colman engineers have solved many a hitherto "impossible" production problem. When victory is won, talent like this should prove equally capable in solving problems of production for peace.

Barber-Colman Company

GENERAL OFFICES AND PLANT • 204 LOOMIS STREET • ROCKFORD, ILLINOIS, U. S. A.

Complete Cutting Tool Service • Engineering • Manufacturing

Hobs • Milling Cutters • Reamers • Special Tools • Sharpening Machines

October Coal Statistics Give Poor Supply Outlook

• • • **Harold L. Ickes,** Solid Fuels Administrator for War, issued statistical reports showing coal production for the week ended Oct. 2 and the condition of consumers' stockpiles at the end of the month of August.

The estimated production of bituminous coal for the week ended Oct. 2 was 12,080,000 tons as compared with 12,100,000 tons for the week ended Sept. 25. The Bureau of Mines estimated production of anthracite for the week ended Oct. 2 at 1,283,000 tons.

Figures on stocks of bituminous coal held in storage by consumers show that production has lagged behind requirements of a considerable period of time. On Jan. 1, 1942, consumers' stockpiles totaled 62,737,000 tons. On Sept. 1, 1942, these stockpiles had been increased to 82,686,000 tons, a gain of 19,949,000 tons as added protection against a possible period of higher requirements and lower production. On Jan. 1, 1943, consumers' stockpiles totaled 85,889,000 tons. Stocks held by consumers as of Sept. 1, 1943, were 75,292,000 tons. Stocks were reduced 10,597,000 tons this year during the corresponding period in which they were increased 19,949,000 tons last year.

It is currently estimated that 1944 coal requirements will be 620,000,000 tons.

Stocks of bituminous coal in consumers' bins as of Sept. 1 were estimated at 75,292,000 tons as compared with a revised estimate of 75,570,000 tons Aug. 1. The average number of days' supply Sept. 1 was 49 compared with 52 Aug. 1.

Excess Profits Tax Exemption Asked for Small Corporations

• • • **"Public interest demands that no excess profits tax be enacted from any corporation having less than $1 million invested capital; and that only a graduated tax be exacted from corporations having an invested capital between $1 million and $15 million,"** according to Paulsen Spence, president, Spence Engineering Co., Inc., New York, in his statement before the House Ways and Means Committee recently.

"Alternatively," he continued, "I have the honor to suggest that you allow any corporation with an invested capital up to $1 million to earn 10 per cent on its net sales without exacting an excess profit tax—and/or renegotiation. There would be no objection to renegotiation if the law was definite—but as it is—it is delegation run wild. Surely 10 per cent net is not *excess* profit.

"In lieu of the suggestions made above you might wish to consider the desirability of exempting from excess profits taxes that part of the income of small corporations, not exceeding 10 per cent of the net sales, that is reinvested in the business.

"Another deterrent to full production which has probably escaped your notice is the question of excess inventories. Many small corporations like ourselves—in order to be reasonably prompt in their deliveries—require large inventory. If Germany should suddenly surrender and our unfilled orders were to be cancelled—we would be hard put to find enough cash to pay our present taxes.

EXTREMES: The two blades, 18 in. apart, of this aircraft supercharger must operate in temperature extremes of —67 deg. F. and 1500 deg. F. The supercharger impeller (left) is exposed to atmosphere temperatures of —67 deg., while the turbine wheel on the left is driven by the exhaust gases from the engine, usually around 1500 deg. F. This assembly was produced at the Fort Wayne plant of General Electric.

HEAVY WORK MADE LIGHT: Women are employed in a variety of unusual jobs at the Truck & Coach Div. of General Motors, one of which is operating this 35-ton yoke squeezer to set rivets into a chassis frame for a truck. Hoist equipment makes this "typical man's job" into one easy for a woman to handle.

World's largest manufacturer of thread-cutting tools relies on Houghton

SALT BATHS

FOR LONGER TOOL LIFE

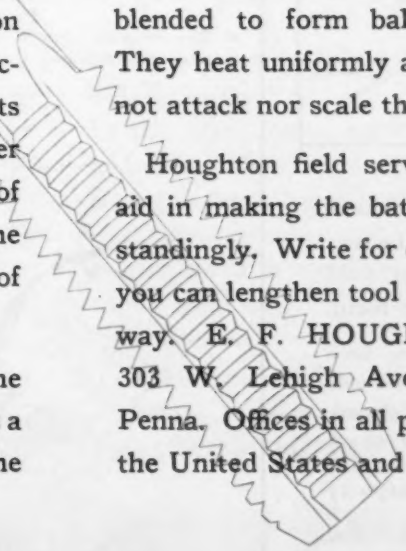
This world-famous maker of tools is but one of many who have long recognized the advantages of the salt-bath method of heat treatment in prolonging the life of precious tools.

The entire Houghton series is here utilized to make better tools—a preheat bath, high-temperature bath, salt quench and draw. By using Houghton salts in modern furnaces, this manufacturer has been able to heat-treat parts more satisfactorily than by any former method attempted. We are told also of the time conserved by using salt—one to one and one-half hours saved out of every 8-hour shift.

Add to this modern procedure the final casing treatment which provides a hard nitrided case on tools after the conventional cycle, and you have tools which will give double and triple the life formerly obtained. With the present crucial shortage of tools, this liquid nitriding is proving to be a definite contribution to war production.

Houghton salt bath materials are made from pure, doubly refined salts blended to form balanced formulæ. They heat uniformly and rapidly; will not attack nor scale the work.

Houghton field service assures full aid in making the baths perform outstandingly. Write for details as to how you can lengthen tool life the salt-bath way. E. F. HOUGHTON & CO., 303 W. Lehigh Ave., Philadelphia, Penna. Offices in all principal cities in the United States and Canada.



HOUGHTON'S LIQUID HEAT

Briefly Told—

New Type Propeller of Sponge Rubber Built; Other Industrial News

• American engineers have now designed and built an entirely new type of airplane propeller. The core is of metal, and the rest is made of hard rubber into which bubbles of gas have been blown. Over this hard sponge rubber is a shell of rubber and neoprene, polished and lacquered. In addition to the neoprene chemical rubber, made by du Pont, neoprene cement and a neoprene binder sheet are also used. Although the new propellers are much lighter in weight, they are able to stand a stress in flight of 60 tons. Their polished surface cuts down drag and wind resistance, and they will hold up in temperatures ranging from —70 deg. F. to 140 deg. F.

•

• Republic Steel Corp. is reported to have acceded to the request of the International Union of Mine, Mill & Smelter Workers, CIO, to postpone the closing of its Raimund ore mine near Birmingham from Oct. 16 to Oct. 29 to give employees further time to relocate themselves. The corporation said it was closing down the mine because of large ore reserves for its Alabama furnaces.

•

• A new 100-octane gasoline plant at the Atlas Works of Socony-Vacuum Oil Co., Buffalo, went into operation this week after a whirlwind conversion job. When peak production is reached, the plant will produce almost enough of the aviation fuel monthly to supply two 1000-plane bombing missions from Britain to Berlin and back. The work of converting began on July 15 and cost approximately $650,000.

•

• The woman power situation in Milwaukee has reached the stage where the government employment office there has an average of five field workers making a daily house to house canvass for industrial workers. Interviewers have found that about 15 per cent of the women contacted have been available for work and of that number from 60 to 75 per cent actually take jobs.

•

• Helicopter production at the Milwaukee Seaman body division of the Nash-Kelvinator Corp. will be relocated and subcontracted by order of the Army Air Force because of the critical labor situation at Milwaukee. For the time being, Seaman will continue the process engineering work being done.

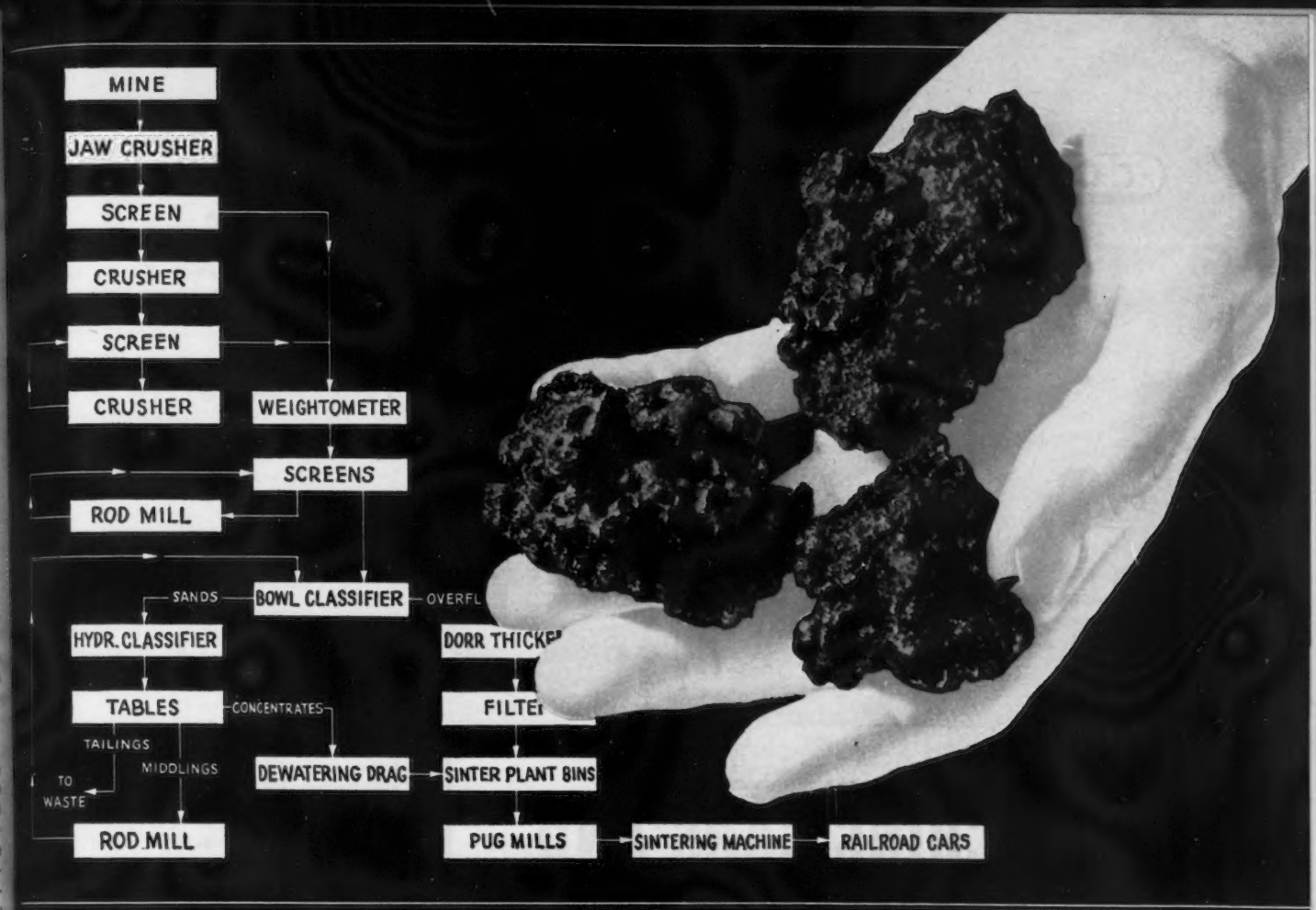
•

• According to Merco Nordstrom Valve Co., available manufacturing facilities not suitable for the production of critical steel valves are being devoted to semi-steel valves. This will permit immediate stock deliveries of certain sizes and figure numbers, thus relieving an aggravating condition in many industries. In the near future, the firm states, orders will be largely completed for top priority Nordstrom cast steel valves desperately needed in synthetic rubber plants and high octane refineries which in turn gives excellent prospect of delivery within 90 days of steel valves for other uses.

•

• War-induced advances in the use of tin-saving electrolytic tin plate indicate that the so-called "conservation plates" will find considerable postwar application in containers for non-processed foods. K. W. Brighton, American Can Co. research scientist, told members of the

"Who's doin' this fightin'?"



WHO IS *Responsible* WHEN RESPONSIBILITY IS *Divided?*

As shown by this flow sheet for a modern ore beneficiation plant, equipment is required from a number of different manufacturers. None of these suppliers can be held responsible for the performance of the plant as a whole.

Arthur G. McKee & Company accept the responsibility for your entire project under a single contract. All details of design, procurement of all necessary materials and equipment and construction of the plant are handled within our own organization.

In the selection of equipment for crushing, grinding, sizing, concentrating, blending and for agglomerating, whether by sintering, briquetting or nodulizing, experienced McKee engineers draw upon the entire field for equipment that will be best suited to your requirements.

The McKee method eliminates duplication of effort and results in efficient design and construction in the shortest possible time.

Undivided Responsibility in One Organization

Arthur G. McKee & Company

★ *Engineers and Contractors* ★

2300 CHESTER AVENUE • CLEVELAND, OHIO

ROCKEFELLER PLAZA
NEW YORK, N. Y.

COMMERCE BUILDIN
HOUSTON, TEXAS

Electrochemical Society at the mid-October meeting in New York.

•

• Unable to hire enough husky men, American Radiator & Sanitary Corp., Buffalo, will employ muscular schoolboys of 16 or older in its Bond Plant on Saturdays. They will receive 75 to 89c. an hour and will be taught all kinds of metal molding and warehouse work.

•

• Open-mesh steel grating is now being used as a "hot seat" to retrieve lead and copper for the war effort, engineers of the Irving Subway Grating Co., Long Island City, reported recently. The new smelting development calls for the use of grating broiler grid over which workers lay scrap cables cut to three or four ft. in length. Under the grating is a huge cast iron pot and under the pot a fire. The lead, which melts at 600 deg. F., trickles through the grid into the pot and is reclaimed. The copper wire, unaffected because its melting point is about 1750 deg. F., is then allowed to cool off and is put through another reclaiming process.

•

• Domestic bookings of electric industrial trucks and tractors during the month of August totaled 610 units, figures just released by the Industrial Truck Statistical Association, Chicago, indicate. The net value of chasses only booked during August totaled $2,930,767.50 compared with $1,272,064.50 in July.

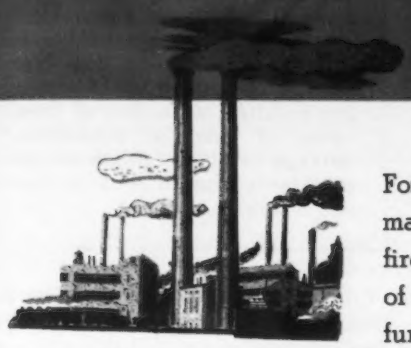
•

• Domestic mills in Canada probably will supply three-fifths of this year's requirements of 5,000,000 tons of steel, according to the Department of Commerce. Production of alloy steels for guns, armor plate and machine tools has been increased to five times that of 1939. Steel ingot production is expected to reach an annual rate of about 3,000,000 tons shortly compared with 1,500,000 tons in 1939.

AUTOMATIC PILOT, a device which automatically keeps planes continuously on a course determined by the human pilot, gets a thorough inspection by Capt. J. S. Evans, at the General Electric Co. With him is C. M. Young of the Aeronautics and Marine Engineering Division.

Insulate with Safety

AT ANY TEMPERATURE



For insulating the refractory linings of industrial furnaces, many combinations of insulating fire brick and refractory fire brick are possible. Harbison-Walker, with complete lines of both insulating fire brick and refractory fire brick, can furnish the correct combination for any service requirements.

	MAXIMUM TEMPERATURE LIMIT	
H-W 16		1600° F
H-W 20		2000° F
H-W 23		2300° F
H-W 26		2600° F
H-W 28		2800° F

APPLICATION

H-W Insulating fire brick are used as insulating backing for the more dense refractory fire brick of various types. They are used also in place of refractory fire brick, directly exposed to furnace atmosphere, but not exposed to slagging action or to severe mechanical abrasion.

SELECTION OF BRAND

Any application of these insulating fire brick requires careful consideration of furnace operating conditions in relation to their maximum temperature limits. When insulating fire brick are used as backing for refractory brick, the maximum operating *interface temperature* between the refractory lining and the insulation governs the choice.

TRADE-MARK

REG. U. S. PAT. OFF.

HARBISON-WALKER REFRACTORIES COMPANY

AND SUBSIDIARIES

WORLD'S LARGEST PRODUCER OF REFRACTORIES

GENERAL OFFICES, PITTSBURGH, PENNA.

OPA Interpretation Given Fluorspar Order

• • • **OPA recently** issued the following interpretation concerning the sales price of fluorspar to make clear that sales may not be broken down to separate charges for the ore and the processing.

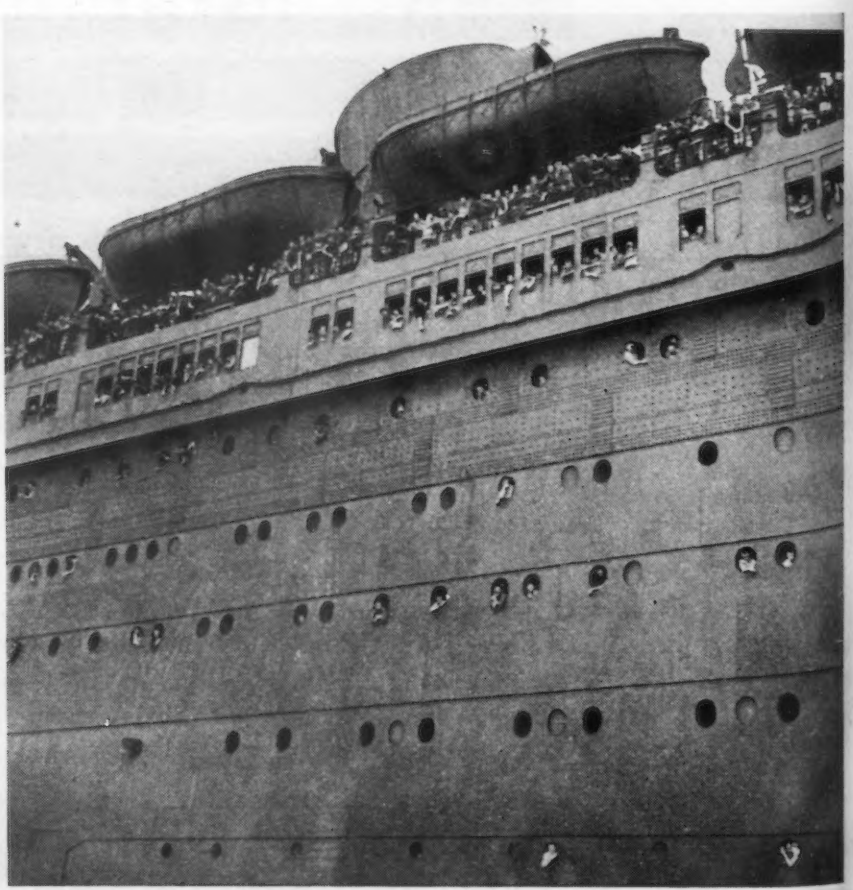
Although MPR-126 provides that sales of crude fluorspar ores are exempt from price regulation, and that contracts which provide for the processing of fluorspar are likewise exempt from price regulation, a processor of fluorspar is not permitted to sell buorspar ore and to make a charge for milling, grinding, or other processing of the ore, if the total of the price for the ore and the charge for processing exceeds the price for fluorspar provided in the regulation. In other words a sale of fluorspar may not be broken down into a sale of fluorspar ore and a processing charge, in order to escape the provisions of the regulation.

Fluorspar ore which is of such purity that it meets the specifications of fluorspar provided in the regulation, and can be used directly without further treatment, is subject to the regulation.

Practical Jokers Impede War Effort

• • • Investigations by the F.B.I. into thousands of plant accidents have shown that the most serious impairment of war production is not from sabotage but from horseplay and practical joking. Since January, 1940, the F.B.I. investigated 11,534 cases of reported sabotage. Less than 10 per cent of these yielded evidence of possible sabotage. In only a few of the 485 cases of persons convicted under the Federal sabotages and related statutes was there a deliberate attempt to impede the war effort. Ill-advised prankishness has resulted in the loss of thousands of hours of production, damage to plant equipment and machinery, and in some instances, injury to workers.

QUEEN MARY'S NEW JOB: U. S. Troops crowd the decks and portholes of the huge British luxury liner at Rio de Janeiro, Brazil. The liner has carried troops to battlefronts throughout the world.



Canadian Iron Output Up, Ingots Down

Toronto

• • • **While pig iron** production in Canada in August showed a gain over July, declines were reported in steel ingots and castings as well as in ferro-alloys. For the eight months ending with August, pig iron production fell 10.5 per cent below the high record for the same period last year, output of steel ingots and castings was down 8.5 per cent, while ferro-alloys showed a minor gain.

Production of steel ingots and castings again declined in August, for a total of 246,820 net tons from 250,508 tons in July and compares with 248,868 tons in August, 1942. The month's output included 234,537 tons of steel ingots and 12,283 tons of castings. For the eight months ending August 31, cumulative production totaled 1,996,481 net tons against 2,066,306 tons in the previous year.

August pig iron production amounted to 164,906 net tons compared with 151,369 tons in July and 162,578 tons for August, 1942.

For the eight months ending with August, Canadian blast furnaces poured 1,184,064 tons of pig iron compared with 1,308,731 tons in the corresponding period of 1942. At the end of August 12 of the 13 stacks in Canada were in blast.

Output of ferro-alloys in August amounted to 18,429 net tons compared with 21,408 tons in July and 15,961 tons in August last year. For the eight months production of ferro-alloys totalled 151,630 tons against 140,522 tons in the same period of 1942.

National Founders to Meet Nov. 17-18 in New York

• • • **The annual meeting** of the National Founders Association will be held at the Waldorf-Astoria Hotel, New York, on Nov. 17 and 18, D. C. Bakewell, president of the association, has announced.

Among the subjects to be discussed by noted authorities in various governmental and industrial fields are reconversion, renegotiation, contract termination, and postwar consumer.

PERSONALS

M. N. TRAINER, first vice-president of American Brake Shoe Co., New York.

• **M. N. Trainer** has been elected first vice-president of the American Brake Shoe Co., New York. Mr. Trainer, who joined the company in 1916 as a brake shoe inspector, has been a vice-president since 1933, and president of the company's Brake Shoe & Castings Division since 1939. He will continue as president of that division.

• **A. N. Morton,** vice-president in charge of production for Mack Mfg. Corp., has been appointed a member of the advisory committee for the automotive, farm and tractor liquid-cooled gasoline engine industry, WPB.

• **Willard M. Robinson** has been appointed superintendent of the open hearth department of the Wickwire Spencer Steel Co., Buffalo, succeeding **Karl V. McCausland,** who has retired after 27 years in the position. Mr. Robinson formerly was open hearth superintendent for Phoenix Iron Co., Phoenixville, Pa.

• **R. S. Butler** was appointed assistant comptroller, general accounting, and **Robert Diefendorf** assistant comptroller, plant accounting and statistics, of H. C. Frick Coke Co., U. S. Steel subsidiary. Prior to present appointment, Mr. Butler was tax supervisor, and Mr. Diefendorf cost planning supervisor, for the Frick Co.

G. F. Anderson, assistant comptroller, retired after 47 years of service.

• **Harrison R. Tucker** has recently been made director of aircraft engineering division of Designers For Industry, Inc., Cleveland.

• **Grosvenor S. McKee** has recently been made vice-president and works manager of the Erie and Meadville, Pa., plants of Talon, Inc. Mr. McKee was production manager of the company from 1938 to 1942. Prior to his present appointment he was works manager for the American Type Founders, Inc., Elizabeth, N. J.

GROSVENOR S. McKEE, vice-president and works manager of the Erie and Meadville, Pa., plants of Talon, Inc.

• **Richard C. Bachman** was appointed manager of methods in the engineering bureau, and **Alexander S. Chalfant** as assistant to chief industrial engineer in charge of planning, of Carnegie-Illinois Steel Corp., U. S. Steel subsidiary. Mr. Bachman was formerly with a national advertising concern, while Mr. Chalfant was plant industrial engineer at Carnegie's Duquesne Works since 1940.

• **Whitley B. Moore** has been made director of sales for all divisions of the Timken Roller Bearing Co. He is to be succeeded in his present position of general manager of sales of the Timken Steel and Tube Division by **C. H. McCollam.**

• **Richard P. Brown,** chairman of the board of the Brown Instrument Co., and vice-president of Minneapolis-Honeywell Regulator Co., has been named deputy director of the WPB, Third Region.

• **T. L. Kishbaugh,** who has been with the WPB in Washington as an alloy steel specialist, has returned to his duties as vice-president of the Earle M. Jorgensen Co., Los Angeles.

• **M. G. Huntington** is the new assistant manager of the B. F. Goodrich national sales and service division in Detroit. **C. W. Wacker,** a member of the original equipment division for the last five years has also been made an assistant manager. **K. D. Smith,** in Detroit for the past year for the national sales and service division returns to Washington as manager of government sales and service there.

• **William A. Shulz** has been appointed to the Chicago sales division of Aro Equipment Corp., Bryan, Ohio.

ERNEST N. CALHOUN, president of Edwin L. Wiegand Co., Pittsburgh.

• **E. N. Calhoun** was elected president of the Edwin L. Wiegand Co., Pittsburgh. Mr. Calhoun joined the company in 1922 as a salesman and has held the offices of treasurer and general sales manager. **Edwin L. Wiegand,** who founded the company 28 years ago, becomes chairman of the board. **A. P. Wiegand** was elected senior vice-president in charge of manufacturing.

• **G. A. Burrell** has been elected president of the Burrell Technical Supply, Co., Pittsburgh. Other officers elected at the same time were **G. H. Burrell**, vice-president and general manager; **C. S. Steenson**, secretary and treasurer; **E. Dollhopf**, manager of purchases; and **R. M. Arnold**, manager of sales.

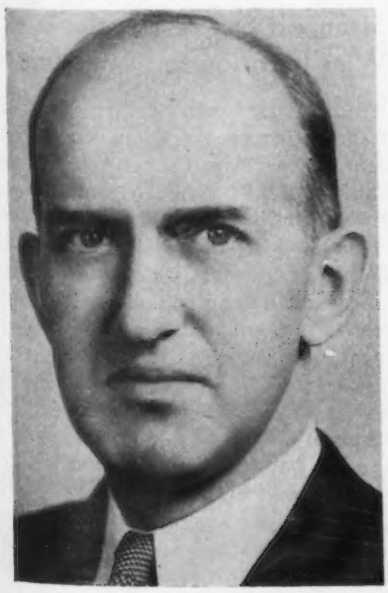
• **Joseph B. Grinnell** has joined the Cochrane Steam Specialty Co., Boston. Mr. Grinnell was formerly associated with the Whitty Mfg. Co.

• **Tyrrell Krum** has been appointed director of public relations for the Reynolds Metals Co., Richmond, Va. Mr. Krum was recently released from active duty as a Lieutenan-Commander in the Navy. His headquarters will be in Washington.

• **Thomas J. McKay** has been elected chairman of the board of directors of the McKay Co., Pittsburgh. Mr. McKay was formerly president and treasurer of the company. James C. McKay, formerly vice-president, was elected president.

• **W. E. Addicks** has been appointed manager of the New York district office of Cutler-Hammer, Inc., Milwaukee. Mr. Addicks joined the company as an engineer in 1914, and was chief engineer at the New York Works for 10 years. Prior to his new appointment he was in charge of the Boston sales office.

W. E. ADDICKS, manager of the New York district office, Cutler-Hammer, Inc., Milwaukee.



• **Eric E. Backlund** has been made sales manager of Gould Pumps, Inc., Seneca Falls, N. Y. Mr. Backlund has been with the company since 1923.

• **O. J. Schroeder** has been appointed vice-president in charge of manufacturing of the Save Electric Corp., Toledo, Ohio. Mr. Schroeder was formerly with Westinghouse Electric Co.

• **M. A. Moynihan** has retired as secretary-treasurer and executive sales manager of Gemmer Mfg. Co., Detroit. He was one of the founders of the concern 36 years ago.

• **John Gordon Bell** has been appointed district sales manager for metropolitan New York and New England areas of Follansbee Steel Corp. Previously, he was connected with the Cleveland office of Jones & Laughlin Steel Corp.

• **Charles F. Yund** was appointed general agent in Detroit, for the Rock Island Lines. Mr. Yund, who succeeds **H. R. Buchanan**, joined the Rock Island as ticket agent in 1940.

• **William F. Joyce**, former secretary of the Automatic Sprinkler Co. of America, Youngstown, was elected vice-president of the company. **J. J. Power, Jr.**, was elected secretary; and **J. A. Coakley, Jr.**, was advanced from assistant treasurer to treasurer.

• **Clarence B. Moore** has been made head of the rubber division of the Thermoid Co., Trenton, N. J., and **Harry Bourne** has been appointed methods engineer in charge of hose production for that division.

• **Kurt Wandel**, consulting engineer, has joined the Alfred Stauffer Machine Shops, Honey Brook, Pa. He was formerly located at Lukenweld, Inc., Coatesville, Pa.

• **Harry A. Erb** has joined the Worthington Pump & Machinery Corp., Harrison, N. J., as service manager of the Moore Steam Turbine Division, Wellsville, N. Y.

• **Fred H. Pinkerton** has been appointed director of public relations for Reeves Sound Laboratories, Inc. Mr. Pinkerton was formerly manager of sales promotion and advertising of the Industrial Division, United States Rubber Co.

OBITUARY...

• **Walter C. Swickert**, assistant vice-president of the Wheeling Corrugating Co., Wheeling, W. Va., died Oct. 4. He had been with the company since 1925, receiving his position as assistant vice-president in 1937. He was 47 years of age.

• **Herbert John Wills**, a member of the sales engineering staff of the Carborundum Co., Niagara Falls, N. Y., died recently. Mr. Wills joined the company in 1920.

• **Samuel Harden Church**, president of Carnegie Institute and chairman of Carnegie Institute of Technology, died in Pittsburgh recently. Mr. Church was formerly a vice-president of the Pennsylvania Railroad. At the time of his death he was a director of the Blaw-Knox Co. He was 85 years of age.

• **J. E. Brobst**, general consultant of the industrial control engineering division of the General Electric Co., died on September 30. Mr. Brobst had been associated with General Electric for 40 years.

• **Arthur L. Hilbert**, associated with the Vilter Mfg. Co., Milwaukee, for 17 years, as an erecting engineer, died Oct. 4.

• **A. G. McCormick**, president of McCormick Bros. Co., died Oct. 10. Along with his brothers, Mr. McCormick founded the company of which he was president, in the early part of the 1900's. He was 68 years of age.

• **W. J. Totten**, manager of sales, St. Paul district, Illinois Steel Co., died Oct. 9. Mr. Totten had been with the company since 1880, holding the positions of manager of sales for the St. Louis district, and assistant general manager of sales for the Chicago district. He was 82 years of age.

• **Charles M. Hammond**, president of the Hammond V. Irving, Inc., Auburn, N. Y., died recently.

• **William F. Meredith**, founder and president of the Titanium Alloy Mfg. Co., died Sept. 28.

• **Richard Ferguson**, founder and president of the Ferguson Gear Co., Gastonia, N. C., died recently. Mr. Ferguson had been general manager of the Grant Lees Co., Cleveland, prior to forming his own company.

MACHINE TOOLS

. . . News and Market Activities

Helpful Advice Offered to Builders

Cleveland

• • • **Walter W. Tangeman,** at the National Machine Tool Builders Association meeting in Chicago offered sound advice to machine tool builders. Some of his suggestions, in brief, were: (1) Bring production schedules into line with future estimates of requirements as furnished by the WPB tools branch; (2) gain control of parts and sub-assemblies inventories, and liquidate excess stocks; (3) improve delivery times and reduce processing time on machine construction; (4) study the individual builder's market.

Bringing production schedules into line with future requirements has some interesting phases. This does not only mean scheduling future production on expected orders. It means also planning to utilize most efficiently the builder's plant on reduced production schedules. There is more capacity now than will be required, but an efficient utilization of a part of that capacity and a part of available personnel is vital. Also, closer control of purchases of raw materials, study of cost systems employed, and a study of operating costs all come under this heading of scheduling production.

Little need be said of liquidating excess inventories, as every builder realizes the advantage of having cash rather than materials on hand. This phase of the business could well be tied into the next, improving delivery times and reducing processing times on construction. Deliveries can be speeded up by utilizing completed parts and sub-assemblies that are in stock. However, over the long pull, more efficient production systems must likewise be worked out so that delivery times and processing times can be materially reduced.

A study of the individual builder's market is a bit more difficult. No one can foresee the needs of American industry for machine tools five or ten years in advance. However, some builders will find that their sales will not sink to the 25 per cent level predicted while others will find that sales will go much lower. Present backlogs of orders, current rates of sales, and the trend of cancellations will give some indication of the market in the immediate future. This will permit reserving sufficient machine tool capacity to manufacture the tools required by the war effort and at the same time balancing out the remainder of the plant capacity with other types of work.

o o o

War Tools May Be Sent to Schools

Ottawa

• • • **Equipment of vocational** schools in Canadian municipalities is likely to be replaced, when peace comes, from supplies held by the Department of Munitions and Supply, officials stated. The department has made a formal offer to the Labor Department to make available for vocational schools, machine tools and equipment which it has on hand and which is not in use in war plants when the war ends.

Under the stress of vocational training to meet the needs of war industry, equipment of many vocational schools is depreciating far more rapidly than it would in peacetime, and will be in need of replacement by the time the war ends. War demand has sent attendance at the vocational schools to record levels with regular classes augmented by special classes organized through the war emergency training program carried on since 1940 under Dominion-Provincial agreements. Under stress of war requirements the machine tools and equipment in many vocational schools, have been in use on almost 24-hour per day schedules.

•

Builders Continue Busy But Stop Labor Replacements

Cincinnati

• • • **The machine tool** market in this area reflects no interesting new feature. While it appears that no large scale layoffs have occurred in recent weeks, machine tool builders on the whole are not making replacements of men who leave their employ in anticipation of a normal shrinkage of employment as the backlogs continue to diminish. Most plants are still operating at a fair rate with the strong probability that this will continue for the remainder of this year, with a number of plants indicating good production beyond the first quarter of next year.

At the same time, the pressure for conversion to other types of manufacture continues and the number of plants beginning production of other items continues to increase.

Machinery Industry Reduces Accidents

• • • **The machinery industry was one of few industries to reduce both injury and severity rates for 1942 in comparison with 1941. Reductions averaged 8 per cent for frequency and 18 per cent for severity, according to the National Safety Council. The average frequency rate was 11.01 reportable injuries per million hours worked while severity rates averaged 0.66 days disability per thousand hours worked.**

Net reductions in injury rates since 1926 were 47 per cent for frequency and 58 per cent for severity. Large plants had the best 1942 injury records, averaging 10.27 for frequency and 0.62 for severity.

All types of injuries decreased in frequency and severity in comparison with the previous year.

•

Stamped Sleeve Development Wins Citation for Two Men

Cleveland

• • • **George W. Veale,** vice president, Eaton Mfg. Co., and J. V. Randall, a U. S. Army Ordnance employee, were presented with the coveted Ordnance Conversion Citation by Col. H. M. Reedall, Chief of Ordnance, Cleveland district recently. Both men were honored for the development of a stamped sleeve on the 40 mm. Bofors gun carriage for which Eaton Mfg. Co. makes the axle. This stamped sleeve replaced a cast sleeve and the savings accomplished on this contract will amount to about 398,758 lb. of critical alloy steel; 9769 critical man and machine hours; and a saving in cost of approximately $325,000.

Retracting and Repositioning Work Within .0002 OF AN INCH—By Push Button

The most frequently needed function in a precision boring machine is that of retracting the work to facilitate measuring and tool setting.

In the DeVlieg Jigmil, this function is automatic—by fingertip control. Operation of a push button unlocks the table and moves it by rapid traverse to the desired position for measuring. For repositioning, operation of a single push button will cause the table to return to its cutting position by rapid traverse, stopping and locking automatically. Uniformity of selected position for stopping and locking is dependable within .0002".

The DeVlieg Jigmil is a new type machine—has the spacing accuracy of a Jig Borer—Performance Qualities of a Milling Machine—Convenience and Flexibility of a Horizontal Boring Mill. All control is so centered and organized that the operator never has to take his eyes off the work.

Thus, the Jigmil fulfills the machine tool ideal—a powerful and accurate extension of the operator's hand.

Many machines show 75 per cent greater average daily productivity.

DE VLIEG MACHINE COMPANY
450 FAIR AVE. FERNDALE (DETROIT) MICHIGAN

Write for Circular

DEVLIEG MACHINE TOOLS

NON-FERROUS METALS

. . . News and Market Activities

August Scrap Shipments Increase

• • • **Shipment of non-ferrous** scrap from dealers' yards gained during August as did stocks, but dealers' receipts continued to decline for the third consecutive month according to the Bureau of Mines, U. S. Department of the Interior. Shipments to consumers moved up to 75,173 short tons in August, a gain of 1 per cent from the low of 74,624 tons in July, thereby ending the two-month downward trend. Dealers' receipts registered a decline of 2 per cent in August to 75,753 short tons. Inventories of non-ferrous scrap held by dealers continued to rise, marking the fifth consecutive month in which stocks have registered a gain. Again it was found that the increase in total stocks of non-ferrous scrap was caused by the great rise in stocks of aluminum scrap, for stocks of the other non-ferrous scrap metal items fell. On Aug. 31 total dealers' stocks of non-ferrous scrap were 99,069 short tons. As usual, consumers purchased a substantial part of their scrap requirements directly from manufacturing plants, and dealers' figures, therefore, do not cover the total flow of scrap. Figures reported for dealers' stocks and transactions are adjusted each month to cover virtually all non-ferrous scrap metal dealers in the United States, exclusive of peddlers and auto wreckers.

Copper and Brass Scrap: The tight condition in copper-base scrap persisted during August, with consumers continuing to purchase a slightly greater tonnage than dealers received, causing stocks to again decline. The sources of old copper scrap have been drying up and dealers were unable to supply consumers with much scrap of the types needed for 85-5-5-5 ingot.

Lead and Tin Scrap: Dealers' stocks of lead-base scrap fell less than 1 per cent to 28,740 tons, a level slightly above the average stock figure maintained during the first seven months of 1942. It appears that the dealer trade has finally disposed of the excessive inventories piled up during the last 5 months of 1942 to return to a normal stock level. Shipments to consumers fell gradually from January to May of 1943, but have been quite steady during the past three months, varying less than 2 per cent.

Aluminum Scrap: The supply-demand situation in aluminum scrap showed slight improvement in August with increased shipments to consumers. A three-month decline was ended when 9173 short tons of scrap aluminum were shipped, compared with 8799 tons in July. This improved tone of shipments, however, did not help the inventory picture, for dealers' stocks rose from 15,518 tons on July 31 to 18,012 tons on Aug. 31, to more than double the opening inventory for the year. In spite of a 3-per-cent decline in dealers' receipts of aluminum scrap in August (to 11,667 short tons), shipments continued far below that level, causing the glutted market situation to continue. Stocks of aluminum scrap held by dealers on August 31, 1943, were nearly three times as great as those at the close of August 1942 (6800 tons). Net receipts in August 1943 also exceeded the August 1942 level, but shipments to consumers were below those in August 1942. Reshipments of aluminum scrap among dealers totaled 2504 short tons in August, a 2 per cent decline from the July figure.

Dealers' receipts of non-ferrous scrap from farms, households, factories, utilities, and other industrial sources of supply in 1943, gross weight, in short tons

	Type of Non-Ferrous Scrap Metal						
Month (1943)	Copper	Lead and Tin	Aluminum	Zinc	Nickel	Magnesium	Total
January	37,489	24,481	10,770	3,358	339	187	76,624
February	40,483	21,927	10,395	3,791	353	202	77,151
March	44,712	22,882	12,061	3,692	467	228	84,042
April	44,172	21,605	12,338	3,913	421	262	82,711
May	46,083	21,022	12,240	3,988	361	311	84,005
June	42,512	21,539	11,275	3,653	479	197	79,655
July	39,171	21,919	12,037	3,650	248	162	77,187
August	37,570	22,243	11,667	3,327	480	466	75,753

Dealers' shipments of non-ferrous scrap to consumers in 1943, gross weight, in short tons

	Type of Non-Ferrous Scrap Metal						
Month (1943)	Copper	Lead and Tin[1]	Aluminum	Zinc[1]	Nickel[1]	Magnesium	Total
January	42,073	25,832	10,353	3,464	419	167	82,308
February	41,425	25,024	11,112	4,141	396	197	82,295
March	46,056	24,239	11,597	3,817	459	223	86,391
April	43,556	22,187	11,882	4,310	370	238	82,543
May	45,680	21,347	11,417	4,185	421	287	83,337
June	43,524	22,576	9,158	3,657	413	226	79,554
July	39,464	22,648	8,799	3,263	318	132	74,624
August	38,791	22,358	9,173	3,870	502	479	75,173

[1] Includes scrap melted by dealers.

Dealers' stocks of non-ferrous scrap metals in 1943, gross weight, in short tons

	Type of Non-Ferrous Scrap Metal						
Inventory Date (1943)	Copper	Lead and Tin	Aluminum	Zinc	Nickel	Magnesium	Total
Jan. 1	54,815	37,333	8,720	6,312	911	75	108,166
Jan. 31	50,231	35,982	9,137	6,206	831	95	102,482
Feb. 28	49,289	32,885	8,420	5,856	788	100	97,338
March 31	47,945	31,528	8,884	5,731	796	105	94,989
April 30	48,561	30,946	9,340	5,334	847	129	95,157
May 31	48,964	30,621	10,163	5,137	787	153	95,825
June 30	47,952	29,584	12,280	5,133	853	124	95,926
July 31	47,659	28,855	15,518	5,520	783	154	98,489
Aug. 31	46,438	28,740	18,012	4,977	761	141	99,069

REFINER, SMELTER PRICES

(Cents per lb. unless otherwise noted)

Aluminum, 99+%, del'd	15.00
Aluminum, No. 12 Fdy., (No. 2)	13.50
Aluminum, deoxidizing grades	12.50 to 13.75
Antimony, Asiatic, New York	Nominal
Antimony, American, f.o.b. Laredo, Tex.	14.50
Arsenic, prime white, 99%	4.00
Brass, 85-5-5-5 ingots (No. 115)	12.25
Cadmium, del'd	90.00
Cobalt, 97-99% (dollars per lb.)	$2.11
Copper, electro, Conn. Valley	12.00
Copper, electro, New York	11.75
Copper, lake	12.00
Copper, beryllium, 3.75-4.25% Be; dollars per lb. contained Be	$15.00
Gold, U. S. Treas., dollars per oz.	$35.00
Indium, 99.5%, dollars per troy oz.	$10.00
Iridium, dollars per troy oz.	$165.00
Lead, St. Louis	6.35
Lead, New York	6.50
Magnesium, 99.9+%, carlots	21.50
Magnesium, 12-in. sticks, carlots	30.00
Mercury, dollars per 76-lb. flask, f.o.b. shipping point or port of entry	$191 to $193.00
Nickel, electro	35.00
Palladium, dollars per troy oz.	$24.00
Platinum, dollars per oz.	$35.00
Silver, open market, New York, cents per oz.	44.75
Tin, Straits, New York	52.00
Zinc, East St. Louis	8.25
Zinc, New York	8.67

Copper, Copper Base Alloys

(Mill base, cents per lb.)

	Extruded Shapes	Rods	Sheets
Copper	20.87	....	20.87
Copper, H.R.	....	17.37	....
Copper, drawn	....	18.37	....
Low brass, 80%	....	20.40	20.15
High brass	....	....	19.48
Red brass, 85%	....	20.61	20.36
Naval brass	20.37	19.12	24.50
Brass, free cut	....	15.01	....
Commercial bronze, 90%	....	21.32	21.07
Commercial bronze, 95%	....	21.53	21.28
Manganese bronze	24.00	....	28.00
Phos. bronze, A, B, 5%	....	36.50	36.25
Muntz metal	20.12	18.87	22.75
Everdur, Herculoy, Olympic or equal	....	25.50	26.00
Nickel silver, 5%	....	28.75	26.50
Architect bronze	19.12	....	....

Aluminum

(Cents per lb., subject to extras on gage, size, temper, finish, factor number, etc.)

Tubing: 2 in. O.D. x 0.065 in. wall 2S, 46c. (½H); 52S, 61c. (O); 24S, 67½c. (T).

Plate: 0.250 in. and heavier; 2S and 3S, 21.2c.; 52S, 24.2c.; 61S, 22.8c.; 24S, 24.2c.

Flat Sheet: 0.188 in. thickness; 2S and 3S, 22.7c. a lb.; 52S, 26.2c.; 61S, 24.7c.; 24S, 26.7c.

2000-lb. base for tubing; 30,000-lb. base for plate, flat stock.

Extruded Shapes: "As extruded" temper; 2000-lb. base. 2S and 3S, factor No. 1 to 4, 25.5c.; 14S, factor No. 1 to 4, 35c.; 17S, factor No. 1 to 4, 31c.; 24S, factor No. 1 to 4, 34c.; 53S, factor No. 1 to 4, 28c.; 61S, factor No. 1 to 4, 28½c.

The factor is determined by dividing perimeter of shape by weight per lineal foot.

Wire, Rod and Bar: Base price; 17ST and 11ST-3, screw machine stock. Rounds: ¼ in., 28½c. per lb.; ½ in., 26c.; 1 in., 24½c.; 2 in., 23c. Hexagonals: ¼ in., 34½c. per lb.; ½ in., 28½c.; 1 in., 25½c.; 2 in., 25½c. 2S, as fabricated, random or standard lengths, ¼ in., 24c. per lb.; ½ in., 25c.; 1 in., 24c.; 2 in., 23c. 24ST, rectangles and squares, random or standard lengths. 0.093-0.187 in. thick by 1.001-2.000 in. wide, 33c. per lb.; 0.751-1.500 in. thick by 2.001-4.000 in. wide, 29c.; 1.501-2.000 in. thick by 4.001-6.000 in. wide, 27½c.

Magnesium

Sheet, rod, tubes, bars, extruded shapes subject to individual quotation. Metal turnings: 100 lb. or more, 46c. a lb.; 25 to 90 lb., 56c.; less than 25 lb., 66c.

NON-FERROUS SCRAP METAL QUOTATIONS

(OPA basic maximum prices, cents per lb., f.o.b. point of shipment, subject to quality, quantity and special preparation premiums)

Copper, Copper Base Alloys

OPA Group 1

No. 1 wire, No. 1 heavy copper	9.75
No. 1 tinned copper wire, No. 1 tinned heavy copper	9.75
No. 2 wire, mixed heavy copper	8.75
Copper tuyeres	8.75
Light copper	7.75
Copper borings	9.75
Lead covered copper wire, cable	6.00•
Lead covered telephone, power cable	6.04
Insulated copper	5.10•

OPA Group 2

Bell metal	15.50
High grade bronze gears	13.25
High grade bronze solids	11.50•
Low lead bronze borings	11.50•
Babbitt lined brass bushings	13.00
High lead bronze solids	10.00•
High lead bronze borings	10.00•
Red trolley wheels	10.75
Tinny (phosphor bronze) borings	10.50
Tinny (phosphor bronze) solids	10.50
Copper-nickel solids and borings	9.25
Bronze paper mill wire cloth	9.50
Aluminum bronze solids	9.00
Soft red brass (No. 1 composition)	9.00
Soft red brass borings (No. 1)	9.00
Gilding metal turnings	8.50
Unlined standard red car boxes	8.25
Lined standard red car boxes	7.75
Cocks and faucets	7.75
Mixed brass screens	7.75
Red brass breakage	7.50
Old nickel silver solids, borings	6.25
Copper lead solids, borings	6.25
Yellow brass castings	6.25

OPA Group 3

Yellow brass soft sheet clippings	8.625
Yellow rod brass turnings	8.375
Zincy bronze borings	8.00
Zincy bronze solids	8.00
Fired rifle shells	8.25
Brass pipe	8.00
Old rolled brass	7.75
Admiralty condenser tubes	8.00
Muntz metal condenser tubes	7.50
Plated brass sheet, pipe reflectors	7.50
Manganese bronze solids	7.25[1]
Manganese bronze solids	6.25[2]
Manganese bronze borings	6.50[1]
Manganese bronze borings	5.50[2]

OPA Group 4

Automobile radiators	7.00

OPA Group 5

Refinery brass	5.00•

•Price varies with analysis. [1]Lead content 0.00 to 0.40 per cent. [2]Lead content 0.41 to 1.00 per cent.

Aluminum

Plant scrap, segregated

2S solids	9.00
All other solids	8.50
Borings and turnings	
W'rt alloys (17S, 18S, 32S, 52S)	7.50
High grade alloys	7.00
Low grade alloys	6.50

Plant scrap, mixed

All solids	7.50
Borings and turnings	5.50

Obsolete scrap

Pure cable	9.00
Old sheet and utensils	7.50
Old castings and forgings	8.00
Pistons, free of struts	8.00
Pistons, with struts	6.00
Old alloy sheet	7.00

For old castings and forgings, pistons, sheets, add ½c. lb. for lots 1000 to 19,999 lb.; for other scrap add 1c.; for lots over 19,999 lb. add 1½c. a lb.

Magnesium

Segregated plant scrap

Pure solids and all other solids, exempt	
Borings and turnings	8.00

Mixed, contaminated plant scrap

Grade 1 solids	11.00
Grade 1 borings and turnings	7.00
Grade 2 solids	9.00
Grade 2 borings and turnings	5.00

For lots over 1499 lb. add 1c. per lb.

Zinc

New zinc clippings, trimmings	7.25
Engravers', lithographers' plates	7.25
Old zinc scrap	5.75
Unsweated zinc dross	5.80
Die cast slab	5.80
New die cast scrap	4.95
Radiator grilles, old and new	4.95
Old die cast scrap	4.50

Lead

Deduct 0.55c. a lb. from refined metal basing point prices for soft and hard lead inc. cable, for f.o.b. point of shipment price.

Nickel

Ni content 98+%, Cu under ½%, 26c. per lb.; 90 to 98% Ni, 26c. per lb. contained Ni.

ELECTROPLATING ANODES AND CHEMICALS

Anodes

(Cents per lb., f.o.b. shipping point)

Copper: Cast, elliptical, 15 in. and longer	25⅛
Electrolytic, full size	22⅞
cut to size	30⅛
Rolled, oval, straight, 15 in. and longer	23¼
Curved	24¼
Brass: Cast, 82-20, elliptical, 15 in. and longer	23⅝
Zinc: Cast, 99.99, 16 in. and over	16¼
Nickel: 99% plus, cast	47
Rolled, depolarized	48
Silver: Rolled, 999 fine per Troy (1-9) oz., per oz.	58

Chemicals

(Cents per lb., delivery from New York)

Copper cyanide, tech., 100-lb. bbls. 1-5	5.65
Copper sulphate, 99.5 crystals, bbls.	13.00–13.50
Nickel salts, single, 425-lb. bbls.	34.00
Silver cyanide, 100 oz. lots	40.32–41.125
Sodium cyanide, 96% dom., 100-lb. dms.	0.15
Zinc cyanide, 100-lb. dms.	33.00
Zinc sulphate, 89% crystals, bbls.	6.80

SCRAP

. . . News and Market Activities

Aid Seen for Alloy Scrap Movement

• • • **Good news** for the scrap industry is seen in the recent recommendation of the WPB Steel Division's industry advisory committee which called for at least 60 per cent greater utilization of triple-alloy steels in engineering and construction applications. When actually effected, this move would seem to point to the creation of a far larger market for the alloy turnings which have been so plentiful and hard to move thus far.

Typical of the triple-alloy steels included under this recommendation are the NE 9400, NE 8600 and SAE 4300 series.

For a long time the distribution of alloys for the melting of tool and stainless steels has been based upon obtaining a substantial proportion of the requirements from steel scrap. More recently, in the case of the engineering alloy steels, steps have been taken to assure full use of all the turnings being generated currently and to control the proper classification of alloy steel scrap by types. Through Order M-21-a the WPB required the charging of alloy scrap in an amount not less than 8 per cent of the total weight of ingots produced during each month. The compulsory segregation of alloy steel scrap into different classes by composition is described in Order M-24-c.

In a recent month the alloy steel turnings consumed exceeded 12 per cent of the total alloy steel ingot production, leading to significant conservation of the contained alloying metals. However, the ultimate potentialities of these efforts cannot be realized unless a broader demand for the nickel - chromium - molybdenum steels is created. The triple alloy steels have the advantage of providing flexibility in the use of alloy steel scrap without which the needs for the alloying metals would have to be satisfied to an ever greater extent from the virgin materials. Since larger quantities of scrap can be used in making up furnace charges of these steels, the stockpiling of alloy steel scrap would be relieved, with consequent increase in the amount of alloying elements recovered.

From the metallurgical standpoint, the alloy steels containing combinations of nickel, chromium, and molybdenum have always enjoyed a good reputation. At present these steels are being employed in a wide variety of applications in Army and Navy material, aircraft, heavy machinery, transportation equipment, and other important uses. In these circumstances everything possible is to be done to convert the engineering and constructional alloy steels to the triple alloy compositions.

•

BUFFALO—First delivery of battlefield scrap was made here this week with the unloading of six canal barges containing a total of 3000 tons shipped from an undisclosed eastern seaport. A local mill received the consignment which contained tank treads and turrets, howitzers and cannon. One of the big guns, made in Italy, had been torn by a muzzle burst. It was emphasized all the war scrap had been checked thoroughly for explosives which might injure workmen who will prepare the material for the open hearths. Some mixed scrap also was in the lot. Canal authorities expressed the opinion considerably more battlefield scrap would be delivered here before the cross-state waterway to New York City freezes.

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The American Locomotive Co. plant at Dunkirk, N. Y., which completed on May 15, 1941, its first 155-mm. rifle carriage, has finished its contract for such carriages and is turning to production of more locomotive parts and additional work on Alco products.

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Repair of freight cars of all types is keeping Buffalo's railroad shops humming with some workers putting in a seven-day week and all others working six days. Volume of business is double that of pre-war days.

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AKRON, OHIO — Enough equivalent energy to lift a 10,000-ton Liberty ship two and a half feet is built into a new machine for testing airplane wheels, tires and brakes which the Goodyear Tire & Rubber Co. placed in operation recently. The machine can test landing loads up to 40,000 lb. per wheel, tire or brake. It utilizes a wheel which is 10 ft. in diameter and with a top speed equivalent to 200 miles per hour. By means of 21 plates distributed on both sides of the center wheel, the "dead weight" can be increased or decreased as desired.

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PITTSBURGH—The scrap picture here is still one of tightness, with some steel interests becoming worried over the coal outlook. Scrap drives are not yet meeting the success necessary to insure an adequate supply this winter, although enthusiasm has improved slightly. Brokers and dealers are not successful in obtaining all the scrap demanded by consumers, especially open hearth and blast furnace grades although foundry grades seem sufficient at this time.

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ST. LOUIS—Donations to the Victory Scrap Bank Drive fell far short of those made in a similar campaign last year, according to the results of the first week in metropolitan St. Louis. Results from the country also are off because of a shortage of trucks and manpower. Allocations through railroads are expected to help, but the situation is regarded as serious.

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PHILADELPHIA—Mills this week are showing a little more interest in asking for heavier shipments than they have in previous weeks, especially in open hearth and cast grades. Steel mill cast and foundry cast are still tight. The supply and demand in low phos scrap are apparently in balance since no complaints of insufficient quantities are forthcoming.

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NEW YORK—Scrap situation is still unchanged. Alloy turnings and solids are practically impossible to move at present. The supply of cast scrap is insufficient to meet demands.

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BOSTON—Things remain quiet. Instead of banks, the WLB has arranged with yards to accept drive scrap on Sundays, the day most of the scrap will be collected. Salvage managers admit they expect to collect not more than 10 per cent of the 1942 drive tonnage. Industry will furnish the bulk of scrap this year. Some plants already have or are about to contribute their salvaged material. Such donations have not been sizeable as yet.

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BIRMINGHAM—The strike of Alabama coal miners has dulled rather than increased the scrap market activity in this area. Mills have been waiting for the coal situation to clarify before requesting shipment of material.

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CINCINNATI—With cold weather only a short distance off, scrap dealers are renewing their warnings of the probability of a shortage in scrap material in the next 30 days. High grade scrap material continues to be difficult to obtain, although melters have a currently adequate supply in most items except No. 1 cast. Alloys continue to be a strong stumbling block, dealers indicate that movement of alloy is virtually impossible without a change in price.

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CHICAGO—Insofar as ferrous scrap is concerned stocks are reported adequate. Foundries report a continued drouth of cast iron scrap. In the non-ferrous field aluminum continues extremely weak with some yards placing an embargo on incoming wrecked aircraft shipments because of sufficient available industrial material. Reticence is also reported in some quarters in accepting fired cartridge cases both because of quality and quantity considerations.

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IRON AND STEEL (OTHER THAN RAILROAD) SCRAP

(All Prices Are Per Gross Ton)

	BASIC OPEN HEARTH GRADES		BLAST FURNACE GRADES				ELECTRIC FURNACE, ACID OPEN HEARTH AND FOUNDRY GRADES									
							Low Phos.		Heavy Structural and Plate			Foundry Steel				
	No. 1 & 2 Hvy. Melt. No. 1 Co. Blk. Shts. No. 1 & 2 Bundles No. 1 Busheling	Unbaled* Machine Shop Turnings	Mixed Borings and Turnings	Cast Iron Borings	Shoveling Turnings	No. 2 Busheling	Billet, Bloom, Forge Crops	Bar Crops, Punchings Plate Scrap and Cast Steel	3 ft. and Under	2 ft. and Under	1 ft. and Under	2 ft. and Under	1 ft. and Under	Auto. Springs, and Crankshafts	Alloy Free Low Phos. and Sulphur Turnings	Heavy Axle and Forge Turn. First Cut	Electric Furnace Bundles
Pittsburgh, Brackenridge, Butler, Monessen, Midland, Johnstown, Sharon, Canton, Steubenville, Warren, Youngstown, Weirton	$20.00	$15.00	$15.00	16.00	$17.00	$17.50	$25.00	$22.50	$21.50	$22.00	$22.50	$21.50	$22.00	$21.00	$18.00	$19.50	$21.00
Cleveland, Middletown, Cincinnati, Portsmouth	19.50	14.50	14.50	15.50	16.50	17.00	24.50	22.00	21.00	21.50	22.00	21.00	21.50	20.50	17.50	19.00	20.50
Chicago, Claymont, Coatesville, Conshohocken, Harrisburg, Phoenixville, Sparrows Point	18.75	13.75	13.75	14.75	15.75	16.25	23.75	21.25	20.25	20.75	21.25	20.25	20.75	19.75	16.75	18.25	19.75
Ashland, Ky.	19.50	14.50	14.50	15.50	16.50	17.00	24.50	22.00	21.00	21.50	22.00	21.00	21.50	20.50	17.50	19.00	20.50
Buffalo, N. Y.	19.25	14.25	14.25	15.25	16.25	16.75	24.25	21.75	20.75	21.25	21.75	20.75	21.25	20.25	17.25	18.75	20.25
Bethlehem, Pa.; Kokomo, Ind.	18.25	13.25	13.25	14.25	15.25	15.75	23.25	20.75	19.75	20.25	20.75	19.75	20.25	19.25	16.25	17.75	19.25
Duluth, Minn.	18.00	13.00	13.00	14.00	15.00	15.50	23.00	20.50	19.50	20.00	20.50	19.50	20.00	19.00	16.00	17.50	19.00
Detroit, Mich.	17.85	12.85	12.85	13.85	14.85	15.35	22.85	20.35	19.35	19.85	20.35	19.35	19.85	18.85	15.85	17.35	18.85
Toledo, Ohio	.....	12.85	12.85	13.85	14.85	15.35	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
St. Louis, Mo.	17.50	12.50	12.50	13.50	14.50	15.00	22.50	20.00	19.00	19.50	20.00	19.00	19.50	18.50	18.50	17.00	18.50
Atlanta, Ga.; Alabama City, Ala.; Birmingham, Los Angeles; Pittsburg, Cal.; San Francisco	17.08	12.00	12.00	13.00	14.00	14.50	22.00	19.50	18.50	19.00	19.50	18.50	19.00	18.00	15.00	16.50	18.00
Minnequa, Colo.	16.50	11.50	11.50	12.50	13.50	14.00	21.50	19.00	18.00	18.50	19.00	18.00	18.50	17.50	14.50	16.00	17.50
Seattle, Wash.	14.50	9.50	9.50	10.50	11.50	12.00	19.50	17.00	16.00	16.50	17.00	16.00	16.00	15.00	12.50	14.00	15.50

*Baled turnings are $5 per gross ton higher.

BUNDLES: Tin can bundles are $4 below dealers' No. 2 bundles No. 3 bundles are $2 less than No. 1 heavy melting.

AT NEW YORK CITY or Brooklyn, the maximum shipping point price is $15.33 for No. 1 heavy melting, f.o.b. cars, f.a.s. vessel or loaded on truck. Minimum set at $14 per grosston at any shipping point in U. S. Other grades carry differentials similar to those in table. New Jersey prices must be computed on basis of all-rail. At Boston the maximum is $15.05 for No. 1 f.o.b. cars, f.a.s. vessel or loaded on trucks. Shipments from a New England shipping point to a consumer outside New England carry maximum transportation charge of $6.66 per ton.

SWITCHING CHARGES: Deductions for shipping points within basing points (cents per gross ton) are: Pittsburgh, Brackenridge, 55c.; Midland, Johnstown, Sharon, Youngstown, Warren, Weirton, Cleveland, Toledo, Los Angeles, San Francisco, 42c.; Butler, Monessen, Canton, Steubenville, Cincinnati*, Portsmouth, Ashland, Coatesville, Harrisburg, Phoenixville, Bethlehem, Kokomo, Duluth, St. Louis, 28c.; Buffalo, Claymont, 36c.; Conshohocken, 11c.; Atlanta, Birmingham, 32c.; Pittsburg, Cal., 42c.; Middletown, 14c.; Sparrow's Point, 11c.; Chicago, 84c.; Detroit, 53c.; Alabama City, 26c.; Minnequa, 22c.; Seattle, 38c. *At Cincinnati, for basic open hearth grades, foundry steel and auto springs and crankshafts, deduct 80c. per ton.

PITTSBURGH basing point includes switching districts of Bessemer, Homestead, Duquesne, Munhall and McKeesport. Cincinnati basing point includes Newport, Ky., switching district. St. Louis includes switching districts of Granite City, East St. Louis, Madison, Ill. San Francisco includes switching districts of S. San Francisco, Niles and Oakmont, Cal. Claymont, Del., includes the switching point of Chester, Pa. Chicago includes Gary, Ind., switching district.

MAXIMUM SHIPPING POINT PRICE—Where shipment is by rail or vessel, or by combination of rail and vessel, the scrap is at its shipping point when placed f.o.b. railroad or f.a.s. vessel. In such cases, the maximum shipping point prices shall be: (a) For shipping points located within a basing point, the price listed in the table above for the scrap at the basing point in which the shipping point is located, minus the lowest established switching charge for scrap within the basing point and (b) for shipping points located outside the basing point, the price in table above at the most favorable basing point minus the lowest transportation charge by rail or water or combination thereof. In lieu of dock charge add 75c. a ton*, but 50c. if moved by deck scow or railroad lighter. Shipping by motor vehicle: The scrap is at its shipping point when loaded. For shipping points located within basing points take price listed in table minus applicable switching charge. If located outside a basing point, the price at the most favorable basing point minus lowest established charge for transporting by common carrier. If no established transportation rate exists, the customary costs are deducted. Published dock charges prevail. If unpublished include 75c.* For exceptions see official order.

UNPREPARED SCRAP: For unprepared scrap, maximum prices shall be $3.50 (and in the case of the material from which No. 1, No. 2, and No. 3 bundles are made $4) less maximum prices for the corresponding grade or grades of prepared scrap. In no case, however, shall electric furnace and foundry grades be used as the "corresponding grade or grades of prepared scrap." Converter may charge $2.50 per ton on consumer-owned unprepared remote scrap (see order). A preparation-in-transit charge for allocated unprepared scrap is provided.

NEW LISTED GRADES: Priced in dollars per gross ton less than No. 1 heavy melting steel. Pit scrap, ladle skulls, slag reclaim, etc., of 85% or more Fe priced—$2; 75 to 85% Fe—$4; under 75% Fe—$8 per ton. Mill scale of 65% or more Fe—$8 per ton. Mill cinder and grindings, shipping point maximum price of $4 per gross ton at all U. S. shipping points.

CHEMICAL BORINGS: No. 1 (new, clean, containing not more than 1 per cent oil), $1 less than No. 1 heavy melting; No. 2 (new, clean, containing not more than 1.5 per cent oil), $2 less than No. 1 heavy melting. If loaded in box cars add 75c.

*At Memphis 50c.; Great Lakes ports $1; New England $1.25.

RAILROAD SCRAP

	No. 1 RR Heavy Melting	Scrap Rails	Rails for Rerolling	Scrap Rails: 3 ft. and Under	Scrap Rails: 2 ft. and Under	Scrap Rails: 18 in. and Under
Cleveland, Cincinnati, Ashland, Portsmouth, Middletown	$20.50	$21.50	$23.00	$23.50	$23.75	$24.00
Canton, Pittsburgh, Sharon, Steubenville, Wheeling, Youngstown	21.00	22.00	23.50	24.00	24.25	24.50
Chicago, Philadelphia, Sparrows Pt., Wilmington	19.75	20.75	22.25	22.75	23.00	23.25
Birmingham, Los Angeles, San Francisco	18.00	19.00	20.50	21.00	21.25	21.50
Buffalo	20.25	21.25	22.75	23.25	23.50	23.75
Detroit	18.85	19.85	21.35	21.85	22.10	22.35
Duluth	19.00	20.00	21.50	22.00	22.25	22.50
Kansas City, Mo.	17.00	18.00	19.50	20.00	20.25	20.50
Kokomo, Ind.	19.25	20.25	21.75	22.25	22.50	22.75
Seattle	15.50	16.50	18.00	18.50	18.75	19.00
St. Louis	18.50	19.50	21.00	21.50	21.75	22.00

CAST IRON SCRAP

	Group A	Group B	Group C
No. 1 cupola cast	$18.00	$19.00	$20.00
Clean auto cast	18.00	19.00	20.00
Unstripped motor blocks	15.50	16.50	17.50
Stove Plate	17.00	18.00	19.00
Heavy Breakable Cast	15.50	16.50	17.50
Charging Box Size Cast	17.00	18.00	19.00
Misc. Malleable	20.00	21.00	22.00

Group A includes the states of Montana, Idaho, Wyoming, Nevada, Utah, Arizona and New Mexico.

Group B includes the states of North Dakota, South Dakota, Nebraska, Colorado, Kansas Oklahoma, Texas and Florida.

Group C: States not named in A and B; switching district of Kansas City, Kan., Mo.

Tool Steel Scrap Ceiling Prices Set by MPR 379, May 4, 1943

	BASE PRICE SEGREGATED		BASE PRICE UNSEGREGATED SOLIDS	BASE PRICE UNSEGREGATED TURNINGS
	Solids, Lb. Cont. W	Turnings, Lb. Cont. W		
Type 1	$1.80	$1.60	$1.50 per lb. contained W if 5% or more.	$1.30 per lb. contained W if 5% or more.
Type 2	1.60	1.40	$1.15 per lb. contained W if over 1% and less than 5%.	$1.00 per lb. contained W if 1% and less than 5%.
Type 3	1.25	1.25		
Type 4*	0.125	0.105	$0.80 per lb. contained Mo if 1½% or more.	$0.70 per lb. contained Mo if 1½% or more.
Type 5*	0.135	0.115		

*Per lb. of scrap material.

Comparison of Prices . . .

Advances Over Past Week in **Heavy Type**; Declines in *Italics*. [Prices Are F.O.B. Major Basing Points]

(Cents Per Lb.)	Oct. 26, 1943	Oct. 19, 1943	Sept. 28, 1943	Oct. 27, 1942
Flat Rolled Steel:				
Hot rolled sheets	2.10	2.10	2.10	2.10
Cold rolled sheets	3.05	3.05	3.05	3.05
Galvanized sheets (24 ga.)	3.50	3.50	3.50	3.50
Hot rolled strip	2.10	2.10	2.10	2.10
Cold rolled strip	2.80	2.80	2.80	2.80
Plates	2.10	2.10	2.10	2.10
Plates, wrought iron	3.80	3.80	3.80	3.80
Stain's c.r. strip (No. 302)	28.00	28.00	28.00	28.00
Tin and Terne Plate: (Dollars Per Base Box)				
Tin plate, standard cokes	$5.00	$5.00	$5.00	$5.00
Tin plate, electrolytic	4.50	4.50	4.50	4.50
Special coated mfg. ternes	4.30	4.30	4.30	4.30
Bars and Shapes: (Cents Per Lb.)				
Merchant bars	2.15	2.15	2.15	2.15
Cold finished bars	2.65	2.65	2.65	2.65
Alloy bars	2.70	2.70	2.70	2.70
Structural shapes	2.10	2.10	2.10	2.10
Stainless bars (No. 302)	24.00	24.00	24.00	24.00
Wrought iron bars	4.40	4.40	4.40	4.40
Wire and Wire Products: (Cents Per Lb.)				
Plain wire	2.60	2.60	2.60	2.60
Wire nails	2.55	2.55	2.55	2.55
Rails: (Dollars Per Gross Ton)				
Heavy rails	$40.00	$40.00	$40.00	$40.00
Light rails	40.00	40.00	40.00	40.00
Semi-Finished Steel: (Dollars Per Gross Ton)				
Rerolling billets	$34.00	$34.00	$34.00	$34.00
Sheet bars	34.00	34.00	34.00	34.00
Slabs	34.00	34.00	34.00	34.00
Forging billets	40.00	40.00	40.00	40.00
Alloy blooms, billets, slabs	54.00	54.00	54.00	54.00
Wire Rods and Skelp: (Cents Per Lb.)				
Wire rods	2.00	2.00	2.00	2.00
Skelp (grvd)	1.90	1.90	1.90	1.90

(Per Gross Ton)	Oct. 26, 1943	Oct. 19, 1943	Sept. 28, 1943	Oct. 27, 1942
Pig Iron:				
No. 2 fdy., Philadelphia	$25.84	$25.84	$25.89	$25.89
No. 2, Valley furnace	24.00	24.00	24.00	24.00
No. 2, Southern Cin'ti	24.68	24.68	24.68	24.68
No. 2, Birmingham	20.38	20.38	20.38	20.38
No. 2, foundry, Chicago†	24.00	24.00	24.00	24.00
Basic, del'd eastern Pa.	25.39	25.39	25.39	25.39
Basic, Valley furnace	23.50	23.50	23.50	23.50
Malleable, Chicago†	24.00	24.00	24.00	24.00
Malleable, Valley	24.00	24.00	24.00	24.00
L. S. charcoal, Chicago	31.34	31.34	31.34	31.34
Ferromanganese‡	135.00	135.00	135.00	135.00
Scrap: (Per Gross Ton)				
Heavy melt'g steel, P'gh.	$20.00	$20.00	$20.00	$20.00
Heavy melt'g steel, Phila.	18.75	18.75	18.75	18.75
Heavy melt'g steel, Ch'go	18.75	18.75	18.75	18.75
No. 1 hy. comp. sheet, Det.	17.85	17.85	17.85	17.85
Low phos. plate, Youngs'n	22.50	22.50	22.50	22.50
No. 1 cast, Pittsburgh	20.00	20.00	20.00	20.00
No. 1 cast, Philadelphia	20.00	20.00	20.00	20.00
No. 1 cast, Ch'go	20.00	20.00	20.00	20.00
Coke, Connellsville: (Per Net Ton at Oven)				
Furnace coke, prompt	$6.50	$6.50	$6.50	$6.00
Foundry coke, prompt	7.50	7.375	6.875	6.875
Non-Ferrous Metals: (Cents per Lb. to Large Buyers)				
Copper, electro., Conn.	12.00	12.00	12.00	12.00
Copper, Lake, New York	12.00	12.00	12.00	12.00
Tin (Straits), New York	52.00	52.00	52.00	52.00
Zinc, East St. Louis	8.25	8.25	8.25	8.25
Lead, St. Louis	6.35	6.35	6.35	6.35
Aluminum, Virgin, del'd.	15.00	15.00	15.00	15.00
Nickel, electrolytic	35.00	35.00	35.00	35.00
Magnesium, ingot	20.50	20.50	20.50	22.50
Antimony (Asiatic), N. Y.	16.50	16.50	16.50	16.50

†The switching charge for delivery to foundries in the Chicago district is 60c. per ton.
‡For carlots at seaboard.

The various basing points for finished and semi-finished steel are listed in the detailed price tables, pages 145-159.

Composite Prices . . .

	FINISHED STEEL	PIG IRON	SCRAP STEEL
Oct. 26, 1943	2.25513c. a Lb.	$23.61 a Gross Ton	$19.17 a Gross Ton
One week ago	2.25513c. a Lb.	$23.61 a Gross Ton	$19.17 a Gross Ton
One month ago	2.25513c. a Lb.	$23.61 a Gross Ton	$19.17 a Gross Ton
One year ago	2.26190c. a Lb.	$23.61 a Gross Ton	$19.17 a Gross Ton

	FINISHED STEEL HIGH	FINISHED STEEL LOW	PIG IRON HIGH	PIG IRON LOW	SCRAP STEEL HIGH	SCRAP STEEL LOW
1943	2.25513c.,	2.25513c.,	$23.61	$23.61	$19.17	$19.17
1942	2.26190c.,	2.26190c.,	23.61	23.61	19.17	19.17
1941	2.43078c.,	2.43078c.,	$23.61, Mar. 20	$23.45, Jan. 2	$22.00, Jan. 7	$19.17, Apr. 1
1940	2.30467c., Jan. 2	2.24107c., Apr. 16	23.45, Dec. 23	22.61, Jan. 2	21.83, Dec. 30	16.04, Apr.
1939	2.35367c., Jan. 3	2.26689c., May 16	22.61, Sept. 19	20.61, Sept. 12	22.50, Oct. 3	14.08, May 1
1938	2.58414c., Jan. 4	2.27207c., Oct. 18	23.25, June 21	19.61, July 6	15.00, Nov. 22	11.00, June
1937	2.58414c., Mar. 9	2.32263c., Jan. 4	23.25, Mar. 9	20.25, Feb. 16	21.92, Mar. 30	12.67, June
1936	2.32263c., Dec. 28	2.05200c., Mar. 10	19.74, Nov. 24	18.73, Aug. 11	17.75, Dec. 21	12.67, June
1935	2.07642c., Oct. 1	2.06492c., Jan. 8	18.84, Nov. 5	17.83, May 14	13.42, Dec. 10	10.33, Apr.
1934	2.15367c., Apr. 24	1.95757c., Jan. 2	17.90, May 1	16.90, Jan. 27	13.00, Mar. 13	9.50, Sept.
1933	1.95578c., Oct. 3	1.75836c., May 2	16.90, Dec. 5	13.56, Jan. 3	12.25, Aug. 8	6.75, Jan.
1932	1.89196c., July 5	1.83901c., Mar. 1	14.81, Jan. 5	13.56, Dec. 6	8.50, Jan. 12	6.43, July
1931	1.99626c., Jan. 13	1.86586c., Dec. 29	15.90, Jan. 6	14.79, Dec. 15	11.33, Jan. 6	8.50, Dec.
1930	2.25488c., Jan. 7	1.97319c., Dec. 9	18.21, Jan. 7	15.90, Dec. 16	15.00, Feb. 18	11.25, Dec.
1929	2.31773c., May 28	2.26498c., Oct. 29	18.71, May 14	18.21, Dec. 17	17.58, Jan. 29	14.08, Dec.

Weighted index based on steel bars, beams, tank plates, wire, rails, black pipe, hot and cold-rolled sheets and strip, representing 78 per cent of the United States output. Index recapitulated in Aug. 28, 1941, issue.

Based on averages for basic iron at Valley furnaces and foundry iron at Chicago, Philadelphia, Buffalo, Valley and Southern iron at Cincinnati.

Based on No. 1 heavy melting steel scrap quotations to consumers at Pittsburgh, Philadelphia and Chicago.

Information Free

(1) Grinding Wheels:

"Helpful Hints and Safety Suggestions" is the title of a 64 page booklet which illustrates what a grinding wheel is, how it is made, and how to use it. Gives rules and examples on how to select the right grade of wheel. Also complete with grinding wheel specifications. *Macklin Company.*

(2) Welding Stainless Steels:

64-page book, illustrated in color, is entitled "Welding Stainless Steel." Divided into six parts, Chapter I deals with effects of heat on stainless steels, Chapter II with metallic arc welding, Chapter III with atomic hydrogen welding, Chapter IV with oxygen-acetylene welding, Chapter V with electrical resistance welding and Chapter VI with welding Pluramelt steels. *Allegheny Ludlum Steel Corp.*

(3) Precision Saws:

40-page booklet describes modern laboratory equipped to solve unusual cutting problems for Doall customers, and shows laboratory reports on typical customer tests, each of which is illustrated. Every kind of material, including metals, alloys, wood, sponge rubber, compositions and synthetics, are put through sawing tests. Each customer receives a report of the research procedure followed in solving his problem; recommendations of the correct saw pitch, temper, set, width and velocity; feeding pressure, cutting speed, etc. *The Doall Co.*

(4) Ring-making Catalog:

24-page catalog dwells specifically upon ring-making and forging as applied to war products. Particular emphasis is placed upon rings that are rolled, welded and sized, a method which effects substantial savings in material and cost as compared with the same rings made in one piece by the conventional methods. The catalog is entitled "Rings for War." *Dresser Mfg. Co.*

(5) Diesel Engines:

Booklet gives brief history of the company's background, together with particulars on design, manufacture and service facilities applicable to the entire commercial line of marine and stationary diesels. Included with the bulletin is a loose leaf supplement sheet giving detailed operating cost data for typical municipal plants. *Fairbanks, Morse & Co.*

(6) Electric Industrial Trucks:

An attractive 76 page booklet shows the reduced number of models which have been "standardized for war" in order to speed production and delivery. Complete specifications on each truck model are given, and also helpful illustrations of Yale trucks at work. *The Yale & Towne Mfg. Company.*

(7) Welding Electrodes:

Comparable chart of stainless steel electrodes lists in easily readable form the arc welding electrodes for various A.I.S.I. stainless steels, and gives chemical analysis of each Arcaloy type. *Alloy Rods Co.*

(8) Hydraulic Pressure Pumps:

Bulletin 250-A offers a comprehensive coverage of the line of Stedifio hydraulic pressure pumps. Photographs show several of the more popular models, with separate illustrations of the important parts. Included is a full-scale sectional elevation drawing, a table giving dimensions (in inches) of the several sizes of pumps and a table of specifications that covers details of each model and size. *The Watson-Stillman Co.*

(9) Contract Manufacturing:

An illustrated 4-page folder listing the manufacturing facilities and layouts of a prominent eastern plant in which thousands of pay station telephones are made. This folder outlines possibilities for increasing or maintaining your production without expanding your own plant. *The Gray Mfg. Company.*

(10) Threading Machines:

The No. 300 Series of rotary die-head general purpose pipe and bolt threading machines are described in 36-page bulletin. Divided into three sections, the first is an operator's manual, the second a maintenance manual, and the third a spare parts manual. *The Oster Mfg. Co.*

(11) Speed Nuts:

20-page bulletin discusses the speed nut principle and assembly advantages. Describes and illustrates various types of nuts, retainer strips, conduit clamps, harness clamps, universal pulley brackets, junction box clips and special shapes. Also gives alphabetical index of suggested typical non-structural speed nut attachments. *Tinnerman Products, Inc.*

(12) Induction Heating:

36-page booklet is concerned with induction heating in connection with welding and pressure work. Briefly discusses the history of induction heating, and goes on with pipe heating, application in boiler and other shops, use in shipyards, materials required, temperature indication and electrical information. *Electric Arc, Inc.*

(13) Electric Motors:

Bulletin describes and illustrates electric motors, gearshift drives, pedestal grinders, magnetic polishing lathes, and special rotors and stations. Illustrates typical installations of various units and shows photographs of their plant. *The Lima Electric Motor Co.*

(14) Internal Grinder:

Folder is descriptive of the M-H-2 internal grinder with combination hand and hydraulic table operation, and master set of standard plug gages which includes 147 plugs and four handles in a unique plastic case with transparent cover. Also gives report of the most noteworthy developments and industrial trends in connection with both the war effort and the pattern of things to come. *The Sav-Way Co.*

(15) High Temperature Insulation:

Charts to simplify the solution of heat-transfer problems in connection with refractories and high-temperature insulation are contained in a 16-page booklet. Curves on the ten full page charts are plotted in terms of conductivity factors. The novel arrangement makes it possible to use the charts for fire-brick, insulating brick, refractory concrete, plastic refractories or any refractory material for which the conductivity (K-factor) is known. *The Atlas Lumnite Cement Co.*

(16) Heat Treating Fixtures:

16-page booklet illustrates heat treating fixtures for pit-type furnaces for practically all varieties of heat-treating operations, showing how for certain kinds of work the pit-type furnace best utilizes its full loading capacity when the fixtures are especially designed for the part to be treated. Lists other products for electrical resistance uses, for heat or corrosion resisting purposes, for spark plug applications, for radio sets and tube parts and for castings and wrought materials. *Driver-Harris Co.*

(17) Revolver Cranes:

90-page brochure covers revolver cranes from start to finish, in connection with construction, industrial material handling, stevedoring and marine service in steam, electric, gasoline, diesel and diesel-electric. It is profusely illustrated. Also gives hoist specifications for various model numbers. *American Hoist & Derrick Co.*

(18) Overhead Conveyors:

Entitled "Six Years' Output in One Year with Lamson Conveyors," pamphlet explains how installation of overhead conveyors increased production in one plant six times with less clutter on the floor and with ten per cent less help. Photographs show conveyors in operation in various plants throughout the country. *Lamson Corp.*

(19) Heat Treating Furnaces:

Folder deals with furnaces for heat treating tools, dies and parts, non-ferrous castings, aluminum forgings, rivets, glassware and general use in metallurgical laboratories. The furnaces have a heat

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range of from 275 to 1250 deg. F. Shows cross-section of CF-25 gas-fired furnace showing heat distribution and circulation. *Despatch Oven Co.*

(20) Welded Rings and Bands:

Folder outlines twenty-five years of experience in producing welded rings and bands. Describes how rings and bands, machined rings, built-up assemblies and tubing are made and then checked by microscopic examinations of weld structures in the metallurgical laboratory. *The American Welding & Mfg. Co.*

(21) Magnesite Ramming Mixture:

Folder discusses H-W Magnamix, a magnesite ramming mixture, and how it may be used for new bottoms of open hearth and electric steel furnaces and for the maintenance of new bottoms. It may also be used as a monolithic inner lining in non-ferrous metallurgical furnaces where the requirements are for a highly basic refractory. *Harbison-Walker Refractories Co.*

(22) Pulverized Coal Equipment:

Bulletin 276, entitled "Utilizing Pulverized Coal in the Metallurgical Industries" describes in detail pulverized coal equipment and includes a number of interesting designs of modern systems utilizing automatic temperature and pressure controls. The equipment described may be quickly installed to replace fuel oil consuming systems and operating data reveals major economies. *The Amsler-Morton Co.*

(23) Material Handling Equipment:

64-page catalog 435 gives latest information on complete line of Syntron products, which includes electric vibrators for bins, hoppers and chutes, Vibra-Flow vibrating feeders, dry chemical feeder machines, Weigh-Flow gravimetric feeder machines, vibratory paper joggers, hydraulic vibrators, feeders and feeder machines, replacement shaft seals, concrete vibrators, electric hammers and self-contained portable gasoline hammer concrete breakers and rock drills. Shows installations and applications of the various types of equipment. *Syntron Co.*

(24) Electrical Welding:

Bulletin 101-8 describes the Pmco 2S-5 electric resistance welder for aluminum and its alloys. Discusses the Sciaky variable pressure cycle with precompression and how it operates. Pictures mechanical and electrical features, with macrophotos of typical spot welds on 24 ST alclad, magnesium and stainless steel. *Sciaky Bros.*

(25) Industrial Radiography:

100-page booklet provides a concise, elementary text describing the basic physical and chemical principles of radiography as applied to the nondestructive examination of materials, and covering the fundamental requirements for efficient procedure. A short bibliography lists references for further information about various phases of radiographic examination of materials. *Eastman Kodak Co.*

(26) Magnetic Pulleys:

40-page handbook on the operation and maintenance of magnetic pulleys features information on trouble-shooting, trouble prevention, repairs, recommended operating practices and general maintenance. The booklet is liberally illustrated with drawings and diagrams, and includes a number of simple formulae, a pulley selection table and other data. *Dings Magnetic Separator Co.*

(27) Automatic Saw Sharpener:

Folder describes the Howe-Lindsey automatic saw sharpener for quickly reconditioning hack saws, band saws, circular rip saws, metal slitting saws and meat saws. Contains directions for setting up and operating the saw sharpener. *Howe & Son, Inc.*

(28) Files and Rasps:

"File Filosophy" is a brief account of the history, manufacture, variety and uses of files in general and how to get the most out of them. 47-page booklet discusses how files and rasps are made and purposes for which they may be used. Gives file terminology and hints on how to get the most out of files by using the right one for a specific purpose. *Nicholson File Co.*

(29) Compressors, Vacuum Pumps:

15-page Bulletin C-5 gives details of construction of one and two stage rotary compressors and vacuum pumps. Lists advantages obtained and shows photographs of typical installations in various types of plants. *Fuller Co.*

(30) Precision Thread Grinder:

Bulletin E-93 gives complete description of No. 6 precision thread grinder, with double page photograph pointing out salient features. The machine is most modern development in a high speed, precisely built machine tool for the grinding of threads of extreme accuracy. *Landis Machine Co.*

(31) Collet Chucking Fixture:

8-page pamphlet shows how holding and indexing may be simplified and speeded up with the collet chucking fixture. Built in 1 and 2-in. sizes, any number of divisions from 2 to 25 may be made. Contains complete instructions for setting up and operating and illustrates the essential parts of both the indexing and holding fixtures. *Zagar Tool, Inc.*

(32) Industrial Pumps:

60-page Catalog No. 43 gives complete story of each Westco pump with brief descriptions of Pomona pumps. Deals with general information, design detail, principle of operation and operating characteristics of industrial pumping units, as well as sample specifications and engineering data. Illustrated in duotone. *Joshua Hendy Iron Works, Pomona Pump Co. Div.*

(33) Overhead Handling Equipment:

Profusely illustrated booklet points out some advantages of overhead handling to executives and engineers who deal with problems of material handling. Photographs show installations in aircraft, automotive, ceramic and chemical plants, and in foundries, machine shops, metal working shops, etc. *American MonoRail Co.*

(34) Portable Elevating Table:

Folder describes hydraulic elevating tables in either portable model mounted on casters or in stationary model mounted on feet. Illustrates optional equipment, such as single or two-speed foot pumps, table with towing handle, indexing device or retaining bars. Also describes special models. *Lyon-Raymond Corp.*

(35) Miniature Precision Bearings:

Folder is concerned with applications of both radial and pivot series of miniature precision bearings for delicate mechanisms, high load capacities, severe service, low temperature applications and for non-magnetic applications. Gives bearing specifications for both radial and pivot series. *Miniature Precision Bearings.*

(36) Boring and Turning Lathes:

A series of three colorful 8-page bulletins describe complete line of lathes formerly known as "Pittsburgh" lathes. Group 1 Bulletin describes and illustrates the heavy duty 27 and 32-in. and 35-in. medium duty lathes. Group II bulletin gives complete details on extra heavy duty 36-in. and heavy duty 42-in. lathes, while the Group III Bulletin covers the 50 and 60-in. heavy duty lathes. *Sommerfield Machine Co.*

(37) Tool Bits and Holders:

Folder is concerned with newly designed tool bits and holders, stressing the exclusive feature that permits right and left hand turning and forming operations using only one tool bit. *The Triangle Tool Co.*

(38) Conservation of Materials and Machines:

"Saving Critical Manpower, Material, Machines by Doing it Differently" is the title of brochure which gives representative cases where time, materials, manpower, machines and money are saved by simple and obvious methods. *The National Screw & Mfg. Co.*

(39) Automatic Screw Machine:

Folder describes Model 375 automatic screw machine for turning, forming, drilling, reaming, threading, knurling, counterboring, undercutting, tapping, slotting and spotting. Built with five cutting tools, it performs a wide range of diameter, form, pinion turning and knurling operations, all of which can be performed in one production cycle. *Thomas B. Gibbs & Co.*

(40) Thermostatic Bimetal:

Folder describes the new Chace #6650 Bimetal which possesses increased thermal activity, high electrical resistivity, and substantial reduction in weight and mass. Characteristic curves, physical constants and comparison of advantages are included. The company also offers a bulletin on #772 manganese alloy of interest to electrical equipment manufacturers because of its high temperatures coefficient of expansion, high electrical resistivity, high vibration damping constant, and low thermal conductivity. *W. M. Chace Company.*

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. . . Prices of Finished Iron and Steel—

Steel prices shown here are f.o.b. basing points, in cents per lb., unless otherwise indicated. On some products either quantity deductions or quantity extras apply. In many cases gage, width, mutting, physical, chemical extras, etc., apply to the base price. Actual realized prices to the mill, therefore, are affected by extras, reductions, and in most cases freight absorbed to meet competition. Delivered prices do not reflect new 3 per cent tax on freight rates.

Basing Point → / Product ↓	Pittsburgh	Chicago	Gary	Cleveland	Birmingham	Buffalo	Youngstown	Sparrows Point	Granite City	Middletown, Ohio	Gulf Ports, Cars	Pacific Ports, Cars[10]	DELIVERED TO Detroit	New York	Philadelphia
SHEETS															
Hot rolled	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢	2.20¢	2.10¢		2.65¢	2.20¢	2.34¢	2.27¢
Cold rolled[1]	3.05¢	3.05¢	3.05¢	3.05¢		3.05¢	3.05¢		3.15¢	3.05¢		3.70¢	3.15¢	3.39¢	3.37¢
Galvanized (24 ga.)	3.50¢	3.50¢	3.50¢		3.50¢	3.50¢	3.50¢	3.50¢	3.60¢	3.50¢		4.05¢		3.74¢	3.67¢
Enameling (20 ga.)	3.35¢	3.35¢	3.35¢	3.35¢			3.35¢		3.45¢	3.35¢		4.00¢	3.45¢	3.71¢	3.67¢
Long ternes[2]	3.80¢		3.80¢									4.55¢		4.16¢	4.12¢
STRIP															
Hot rolled[3]	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢		2.10¢			2.10¢		2.75¢	2.20¢	2.46¢	
Cold rolled[4]	2.80¢	2.90¢		2.80¢			2.80¢	(Worcester = 3.00¢)					2.90¢	3.16¢	
Cooperage stock	2.20¢	2.20¢			2.20¢		2.20¢							2.56¢	
Commodity C-R	2.95¢	3.05¢		2.95¢			2.95¢	(Worcester = 3.35¢)					3.05¢	3.31¢	
TIN MILL PRODUCTS															
Coke tin plate, base box	$5.00	$5.00	$5.00						$5.10					5.36¢	5.32¢
.50 } Electro tin plate, box	$4.50	$4.50	$4.50												
.75 } Electro tin plate, box	$4.65		$4.65												
Black plate, 29 gage[5]	3.05¢	3.05¢	3.05¢						3.15¢			4.05¢[12]			3.37¢
Mfg. ternes, special box	$4.30	$4.30	$4.30						$4.40						
BARS															
Carbon steel	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢		(Duluth = 2.25¢)			2.50¢	2.80¢	2.25¢	2.49¢	2.47¢
Rail steel[6]	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢					2.50¢	2.80¢			
Reinforcing (billet)[7]	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢			2.50¢	2.55¢[12]	2.25¢	2.39¢	
Reinforcing (rail)[7]	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢				2.50¢	2.55¢[12]	2.25¢		2.47¢
Cold finished[8]	2.65¢	2.65¢	2.65¢	2.65¢		2.65¢			(Detroit = 2.70¢)					2.99¢	2.97¢
Alloy, hot rolled	2.70¢	2.70¢				2.70¢	(Bethlehem, Massillon, Canton = 2.70¢)						2.80¢		
Alloy, cold drawn	3.35¢	3.35¢	3.35¢	3.35¢		3.35¢							3.45¢		
PLATES							(Coatesville and Claymont = 2.10¢)								
Carbon steel	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢		2.10¢	2.10¢	2.35¢		2.45¢	2.65¢	2.31¢	2.29¢	2.15¢
Floor plates	3.35¢	3.35¢									3.70¢	4.00¢		3.71¢	3.67¢
Alloy	3.50¢	3.50¢			(Coatesville = 3.50¢)						3.95¢	4.15¢		3.70¢	3.59¢
SHAPES															
Structural	2.10¢	2.10¢	2.10¢		2.10¢	2.10¢	(Bethlehem = 2.10¢)				2.45¢	2.75¢		2.27¢	2.215¢
SPRING STEEL, C-R															
0.26 to 0.50 Carbon	2.80¢			2.80¢			(Worcester = 3.00¢)								
0.51 to 0.75 Carbon	4.30¢			4.30¢			(Worcester = 4.50¢)								
0.76 to 1.00 Carbon	6.15¢			6.15¢			(Worcester = 6.35¢)								
1.01 to 1.25 Carbon	8.35¢			8.35¢			(Worcester = 8.55¢)								
WIRE[9]															
Bright[14]	2.60¢	2.60¢		2.60¢	2.60¢		(Worcester = 2.70¢)					3.10¢			2.92¢
Galvanized	add proper size extra and galvanized extra to bright wire base, above.														
Spring (High Carbon)	3.20¢	3.20¢		3.20¢			(Worcester = 3.30¢)					3.70¢			3.52¢
PILING															
Steel sheet	2.40¢	2.40¢				2.40¢						2.95¢			2.72¢

[1] Mill run sheets are 10c per 100 lb. less than base; and primes only, 25c. above base. [2] Unassorted 8-lb. coating. [3] Widths up to 12 in. [4] Carbon 0.25 per cent and less. [5] Applies to certain width and length limitations. [6] For merchant trade. [7] Prices for straight length material only, from a producer to a consumer. Functional discount of 25c. per 100 lb. to fabricators. [8] Also shafting. For quantities of 20,000 to 29,999 lb. [9] Carload lot to manufacturing trade. [10] These prices do not apply if the customary means of transportation (rail and water) are not used. [12] Boxed. [13] Portland and Seattle price, San Francisco price is 2.50c. [14] This bright wire base price to be used in figuring annealed and bright finish wires, commercial spring wire and galvanized wire.

GOVERNMENT CEILING—Price Schedule No. 6 issued April 16, 1941, governs steel mill prices; Price Schedule No. 49 governs warehouse prices which are on another page of this issue.

EXCEPTIONS TO PRICE SCHEDULE No. 6—On hot rolled carbon bars, Phoenix Iron Co. may quote 2.35c. at established basing points, Calumet Steel division of Borg Warner may quote 2.35c., Chicago, on bars from its 8-in. mill; Joslyn Mfg. Co. may quote 2.35c., Chicago base. On rail steel bars Sweets Steel Co. may quote 2.35c., f.o.b. mill. On hot rolled sheets, Andrews Steel Co. may quote for shipment to Detroit area on Middletown base; Parkersburg Iron & Steel may quote $2.25 per hundred f.o.b. Parkersburg, W. Va. On galvanized sheets, Andrews Steel may quote 3.75c., at established basing points; Parkersburg Iron & Steel may quote $3.85 per hundred f.o.b. Parkersburg, W. Va. On hot rolled strip, Joslyn Mfg. Co. may quote 2.30c., Chicago base. On plates, Granite City Steel Co. may quote 2.35c., f.o.b. mill, and Central Iron & Steel Co. may quote 2.20c., f.o.b. basing points. On shapes, Phoenix Iron Co. may quote 2.30c. established basing points and 2.50c. Phoenixville for export.

On rail steel merchant bars, Eckels-Nye Corp. may charge 2.40c. On tubing, South Chester Tube Co. may price Gulf or Pacific Coast all-rail shipments and shipments west of Harrisburg on basis of f.o.b. Chester. On lend-lease sales to eastern seaboard, Sheffield Steel Co. and Colorado Fuel & Iron Corp. may sell f.o.b. mill. SEMIFINISHED STEEL—Follansbee Steel Corp. may sell forging billets at $40.50 f.o.b. Toronto; Continental Steel Corp. may sell Acme Steel Co. at $34 for rerolling billets plus extras and freight; Ford Motor Co. may sell rerolling billets at $34 f.o.b. Dearborn; Andrews Steel Co. may sell forging billets at $50 at established basing points and slabs at $41; Empire Sheet and Tin Plate may sell slabs at $41 at established basing points and sheet bars at $39 f.o.b. mill; on lend-lease sales Northwestern Steel & Wire Co. may charge $41 per gross ton f.o.b. mill for rerolling billets; on lend-lease sales Wheeling Steel Corp. may charge $36 per ton for small billets, f.o.b. Portsmouth and $37 per ton for sheet bars f.o.b. Portsmouth; Laclede Steel Co. on semi-finished sales for lend-lease shipped to eastern seaboard may use Chicago basing point prices f.o.b. Alton and Madison, Ill. ALLOY STEEL BARS—Texas Steel Co. may use Chicago base f.o.b. Fort Worth.

WAREHOUSE PRICES

(Delivered Metropolitan areas, per 100 lb. These prices do not necessarily apply for dislocated tonnage shipments when the f.o.b. City prices are used in conformance with OPA Schedule 49)

Cities	SHEETS			STRIP		Plates ¼ in. and heavier	Structural Shapes	BARS		ALLOY BARS			
	Hot Rolled (10 gage)	Cold Rolled	Galvanized (24 gage)	Hot Rolled	Cold Rolled			Hot Rolled	Cold Finished	†† Hot Rolled, 2300	‡ Hot Rolled, 3100	†† Cold Drawn, 2300	‡ Cold Drawn, 3100
*Philadelphia	$3.518	$4.872[5]	$5.018	$3.922	$4.772	$3.605	$3.666	$3.822	$4.072	....	$7.116	....	....
*New York	3.590	4.613[2]	5.010	3.974[6]	4.774	3.768	3.758	3.853	4.103	6.008	7.158	7.303	8.453
*Boston	3.774	4.744	5.224	4.106	4.715	3.912	3.912	4.044	4.144	6.162	7.312	7.344	8.494
*Baltimore	3.394	4.852	4.894	3.902	4.752	3.594	3.759	3.802	4.052	....	....	....	....
*Norfolk	3.771	4.965	5.371	4.165	4.865	3.971	4.002	4.065	4.165	....	....	....	....
*Washington	3.596	4.841	5.196	4.041	4.741	3.796	3.930	3.941	4.041	....	....	....	....
*Chicago	3.25	4.20	5.234	3.60	4.658	3.55	3.55	3.50	3.75	5.75	6.90	6.85	8.00
*Milwaukee	3.387	4.3372	5.2724	3.737	4.7878	3.687	3.687	3.637	3.887	5.987	7.137	7.087	8.237
*Cleveland	3.35	4.40	4.8774	3.60	4.45	3.40	3.588	3.35	3.75	5.956	7.106	6.85	8.00
*Buffalo	3.35	4.40	4.754	3.819	4.669	3.63	3.40	3.35	3.75	5.75	6.90	6.85	8.00
*Detroit	3.45	4.50	5.004	3.70	5.9098	3.609	3.661	3.45	3.80	6.08	7.23	7.159	8.309
*Cincinnati	3.425	4.4752	4.8251	3.675	4.711	3.611	3.691	3.611	4.011	....	....	....	....
*St. Louis	3.397	4.2472	5.1724	3.747	4.9318	3.697	3.697	3.647	4.031	6.131	7.281	7.231	8.381
*Pittsburgh	3.35	4.40	4.75	3.60	4.45	3.40	3.40	3.35	3.75	5.75	7.15	6.85	8.25
*St. Paul	3.51	4.46	5.2574	3.86	4.358	3.819	3.819	3.769	4.361	6.09	7.24	7.561	8.711
*Omaha	3.865	5.443	5.6084	4.215	....	4.165	4.165	4.115	4.443	....	....	....	....
*Indianapolis	3.58	3.58	4.568	4.918	3.768	4.78	3.63	3.58	3.98	6.08	7.23	7.18	8.33
*Birmingham	3.45	....	4.75	3.70	....	3.55	3.55	3.50	4.43	....	....	....	....
*Memphis	3.85	4.66	5.25	4.10	....	3.95	3.95	3.90	4.31	....	....	....	....
*New Orleans	3.95	4.95	5.25	4.20	....	3.90	3.90	4.10	4.60	....	....	....	....
Houston	....	....	....	....	....	....	....	....	....	....	....	....	....
†Los Angeles	....	....	....	....	....	....	....	....	....	....	....	....	....
†San Francisco	....	....	....	....	....	....	....	....	....	....	....	....	....
†Seattle	....	....	....	....	....	....	....	....	....	....	....	....	....

NATIONAL EMERGENCY (N. E.) STEELS

(Hot Rolled Mill Extras for Alloy Content)

Designation	CHEMICAL COMPOSITION LIMITS, PER CENT								Basic Open-Hearth		Electric Furnace	
	Carbon	Manganese	Phosphorus Max.	Sulphur Max.	Silicon	Chromium	Nickel	Molybdenum	Bars and Bar Strip	Billets, Blooms and Slabs	Bars and Bar Strip	Billets, Blooms and Slabs
NE 1330	.28/ .33	1.60/1.90	.040	.040	.20/ .35	.....	.....	.....	.10c	$2.00	.....	.....
NE 1335	.33/ .38	1.60/1.90	.040	.040	.20/ .35	.....	.....	.....	.10	2.00	.....	.....
NE 1340	.38/ .43	1.60/1.90	.040	.040	.20/ .35	.....	.....	.....	.10	2.00	.....	.....
NE 1345	.43/ .48	1.60/1.90	.040	.040	.20/ .35	.....	.....	.....	.10	2.00	.....	.....
NE 1350	.48/ .53	1.60/1.90	.040	.040	.20/ .35	.....	.....	.....	.10	2.00	.....	.....
NE 8613	.12/ .17	.70/ .90	.040	.040	.20/ .35	.40/ .60	.40/ .70	.15/ .25	.75	15.00	1.25	25.00
NE 8615	.13/ .18	.70/ .90	.040	.040	.20/ .35	.40/ .60	.40/ .70	.15/ .25	.75	15.00	1.25	25.00
NE 8617	.15/ .20	.70/ .90	.040	.040	.20/ .35	.40/ .60	.40/ .70	.15/ .25	.75	15.00	1.25	25.00
NE 8620	.18/ .23	.70/ .90	.040	.040	.20/ .35	.40/ .60	.40/ .70	.15/ .25	.75	15.00	1.25	25.00
NE 8630	.28/ .33	.70/ .90	.040	.040	.20/ .35	.40/ .60	.40/ .70	.15/ .25	.75	15.00	1.25	25.00
NE 8635	.33/ .38	.75/1.00	.040	.040	.20/ .35	.40/ .60	.40/ .70	.15/ .25	.75	15.00	1.25	25.00
NE 8637	.35/ .40	.75/1.00	.040	.040	.20/ .35	.40/ .60	.40/ .70	.15/ .25	.75	15.00	1.25	25.00
NE 8640	.38/ .43	.75/1.00	.040	.040	.20/ .35	.40/ .60	.40/ .70	.15/ .25	.75	15.00	1.25	25.00
NE 8642	.40/ .45	.75/1.00	.040	.040	.20/ .35	.40/ .60	.40/ .70	.15/ .25	.75	15.00	1.25	25.00
NE 8645	.43/ .48	.75/1.00	.040	.040	.20/ .35	.40/ .60	.40/ .70	.15/ .25	.75	15.00	1.25	25.00
NE 8650	.48/ .53	.75/1.00	.040	.040	.20/ .35	.40/ .60	.40/ .70	.15/ .25	.75	15.00	1.25	25.00
NE 8720	.18/ .23	.70/ .90	.040	.040	.20/ .35	.40/ .60	.40/ .70	.20/ .30	.80	16.00	1.30	26.00
NE 9255	.50/ .60	.70/ .95	.040	.040	1.80/2.20	.....	.....	.....	.40	8.00	.....	.....
NE 9260	.55/ .65	.70/1.00	.040	.040	1.80/2.20	.....	.....	.....	.40	8.00	.....	.....
NE 9261	.55/ .65	.70/1.00	.040	.040	1.80/2.20	.10/ .25	.....	.....	.65	13.00	.....	.....
NE 9262	.55/ .65	.70/1.00	.040	.040	1.80/2.20	.25/ .40	.....	.....	.65	13.00	.....	.....
NE 9415	.13/ .18	.80/1.10	.040	.040	.20/ .35	.30/ .50	.30/ .60	.08/ .15	.75	15.00	1.25	$25.00
NE 9420	.18/ .23	.80/1.10	.040	.040	.20/ .35	.30/ .50	.30/ .60	.08/ .15	.75	15.00	1.25	25.00
NE 9422	.20/ .25	.80/1.10	.040	.040	.20/ .35	.30/ .50	.30/ .60	.08/ .15	.75	15.00	1.25	25.00
NE 9425	.23/ .28	.80/1.10	.040	.040	.20/ .35	.30/ .50	.30/ .60	.08/ .15	.75	15.00	1.25	25.00
NE 9430	.28/ .33	.90/1.20	.040	.040	.20/ .35	.30/ .50	.30/ .60	.08/ .15	.75	15.00	1.25	25.00
NE 9435	.33/ .38	.90/1.20	.040	.040	.20/ .35	.30/ .50	.30/ .60	.08/ .15	.75	15.00	1.25	25.00
NE 9437	.35/ .40	.90/1.20	.040	.040	.20/ .35	.30/ .50	.30/ .60	.08/ .15	.75	15.00	1.25	25.00
NE 9440	.38/ .43	.90/1.20	.040	.040	.20/ .35	.30/ .50	.30/ .60	.08/ .15	.75	15.00	1.25	25.00
NE 9442	.40/ .45	1.00/1.30	.040	.040	.20/ .35	.30/ .50	.30/ .60	.08/ .15	.80	16.00	1.30	26.00
NE 9445	.43/ .48	1.00/1.30	.040	.040	.20/ .35	.30/ .50	.30/ .60	.08/ .15	.80	16.00	1.30	26.00
NE 9450	.48/ .53	1.20/1.50	.040	.040	.20/ .35	.30/ .50	.30/ .60	.08/ .15	.80	16.00	1.30	26.00
NE 9537*	.35/ .40	1.20/1.50	.040	.040	.40/ .60	.40/ .60	.40/ .70	.15/ .25	1.20	24.00	1.70	34.00
NE 9540*	.38/ .43	1.20/1.50	.040	.040	.40/ .60	.40/ .60	.40/ .70	.15/ .25	1.20	24.00	1.70	34.00
NE 9542*	.40/ .45	1.20/1.50	.040	.040	.40/ .60	.40/ .60	.40/ .70	.15/ .25	1.20	24.00	1.70	34.00
NE 9545*	.43/ .48	1.20/1.50	.040	.040	.40/ .60	.40/ .60	.40/ .70	.15/ .25	1.20	24.00	1.70	34.00
NE 9550*	.48/ .53	1.20/1.50	.040	.040	.40/ .60	.40/ .60	.40/ .79	.15/ .25	1.20	24.00	1.70	34.00

BASE QUANTITIES: Hot rolled sheets, cold rolled sheets, hot rolled strip, plates, shapes and hot rolled bars, 400 to 1999 lb.; galvanized sheets, 150 to 1499 lb.; cold rolled strip, extras apply on all quantities; cold finished bars, 1500 lb. and over; SAE bars, 1000 lb. and over: Exceptions: [1] 500 to 1499 lb. [2] 400 to 1499 lb. [3] 400 to 3999 lb. [4] 450 to 1499 lb. [5] 1000 to 1999 lb. [6] 0 to 1999 lb. [7] 300 to 10,000 lb. [8] 2000 to 39,999 lb. [9] 400 to 14,999 lb. At Philadelphia galvanized sheets, 2500 more bundles; Boston, cold rolled and galvanized sheets, 450 to 3749 lb.; San Francisco, hot rolled sheets, 400 to 39,999 lb.; galvanized and cold rolled sheets, 750 to 4999 lb.; cold fin. bars, 0-299 lb.; hot rolled alloy bars, 0-4999 lb.; Seattle, cold finished bars, 1000 lb. and over, hot rolled alloy bars, 0-1999 lb.; Memphis, hot rolled sheets, 400 to 1999 lb., galvanized sheets, 150 and over; Los Angeles, hot rolled sheets, bars, plates, cold rolled sheets, 300 to 1999 lb.; galvanized sheets, 1 to 6 bundles; cold finished bars, 1 to 99 lbs.; SAE bars, 100 lb. Extras for size, quality, etc., apply on above quotations.

† Los Angeles, San Francisco and Seattle prices reflect special provisions of amendment No. 2 to OPA Price Schedule No. 49.

†† For zoned cities these grades have been revised to NE 8617-20.

‡ For zoned cities these grades have been revised to NE 9442-45 Ann'ld.

* Base delivered prices according to price zones established by Amendments to RPS 49 including the 3% transportation tax—not including the 6% freight increase of March 18, 1942, rescinded May 15, 1943.

*Recommended for large sections only. Note: The extras shown above are in addition to a base price of 2.70c. per 100 lb., on finished products and $54 per gross ton on semi-finished steel major basing points and are in cents per 100 lb. and dollars per gross ton in semi-finished. When acid open-hearth is specified and acceptable add to basic open hearth alloy differential 0.25c. per lb. for bars and bar strip, $5.00 per gross ton for billets, blooms and slabs. The ranges shown above are restricted to sizes 100 sq. in. or less or equivalent cross sectional area 18 in. wide or under with a max. individual piece weight of 7000 lb.

PRICES

CAST IRON WATER PIPE

	Per Net Ton
6-in. and larger, del'd Chicago	$54.80
6-in. and larger, del'd New York	52.20
6-in. and larger, Birmingham	46.00
6-in. and larger f.o.b. cars, San Francisco or Los Angeles	69.40
6-in. and larger f.o.b. cars, Seattle	71.20

Class "A" and gas pipe, $3 extra; 4-in. pipe is $3 a ton above 6-in. Prices shown are for lots of less than 200 tons. For 200 tons or over, 6-in. and larger is $45 at Birmingham and $53.80 delivered Chicago, $59.40 at San Francisco and Los Angeles, and $70.20 at Seattle. Delivered prices do not reflect new 3 per cent tax on freight rates.

LAKE SUPERIOR ORES

(51.50% *Fe, Natural Content, Delivered Lower Lake Ports**)

	Per Gross Ton
Old range, bessemer, 51.50	$4.75
Old range, non-bessemer, 51.50	4.60
Mesaba, bessemer, 51.50	4.60
Mesaba, non-bessemer, 51.50	4.45
High phosphorus, 51.50	4.35

*Adjustments are made to indicate prices based on variance of Fe content of ores as analyzed on a dry basis by independent laboratories.

COKE

Furnace

	Per Net Ton
†Connellsville, prompt	$6.50*

Foundry

†Connellsville, prompt	7.50
Fayette County, W. Va. (Beehive)	8.10
By-product, Chicago	12.25
By-product, New England	13.75
By-product, Newark	12.40 to 12.95
By-product, Philadelphia	12.38
By-product, Cleveland	12.30
By-product, Cincinnati	11.75
By-product, Birmingham	8.50†
By-product, St. Louis	12.02
By-product, Buffalo	12.50

Maximum by-product coke prices established by OPA became effective Oct. 1, 1941.

*Hand-drawn ovens using trucked coal are permitted to charge $7.00 per net ton, plus usual transportation. Maximum beehive furnace coke prices established by OPA, Feb. 8, 1942. †F.o.b. oven.

FLUORSPAR

Maximum price f.o.b. consumer's plant, $30 per short ton plus either (1) rail freight from producer to consumer, or (2) rail freight from Rosiclare, Ill., to consumer, whichever is lower.

Exception

When the WPB Steel Division certifies in writing the consumer's need for one of the higher grades of metallurgical fluorspar specified in the table below the price shall be taken from the table plus items (1 and 2) from paragraph above.

Effective CaF_2 Content:	*Base price per short ton*
70% or more	$33.00
65% but less than 70%	32.00
60% but less than 65%	31.00
Less than 60%	30.00

REFRACTORIES

(*F.o.b. Works*)

Fire Clay Brick	*Per 1000*
Super-duty brick, St. Louis	$64.60
First quality, Pa., Md., Ky., Mo., Ill.	51.30
First quality, New Jersey	56.00
Sec. quality, Pa., Md., Ky., Mo., Ill.	46.55
Second quality, New Jersey	51.00
No. 1, Ohio	43.00
Ground fire clay, net ton	7.60
Silica Brick	
Pennsylvania and Birmingham	$51.30
Chicago District	58.90
Silica cement, net ton (Eastern)	9.00
Chrome Brick	*Per Net Ton*
Standard, chemically bonded, Balt., Plymouth Meeting, Chester	$54.00
Magnesite Brick	
Standard, Balt. and Chester	$76.00
Chemically bonded, Baltimore	65.00
Grain Magnesite	
Domestic, f.o.b. Balt. and Chester in sacks (carloads)	$44.00
Domestic, f.o.b. Chewelah, Wash. (in bulk)	22.00

PRICES

BOLTS, NUTS, RIVETS, SET SCREWS

Bolts and Nuts

(F.o.b. Pittsburgh, Cleveland, Birmingham or Chicago)

Machine and Carriage Bolts:

	Per Cent Off List
½ in. & smaller x 6 in. & shorter	65½
9/16 & ⅝ in. x 6 in. & shorter	63½
¾ to 1 in. x 6 in. & shorter	61
1⅛ in. and larger, all length	59
All diameters over 6 in. long	59
Lag, all sizes	62
Plow bolts	65

Nuts, Cold Punched or Hot Pressed:
(Hexagon or Square)

½ in. and smaller	62
9/16 to 1 in. inclusive	59
1⅛ to 1½ in. inclusive	57
1⅝ in. and larger	56

On above bolts and nuts, excepting plow bolts, additional allowance of 10 per cent for full container quantities. There is an additional 5 per cent allowance for carload shipments.

Semi-Fin. Hexagon Nuts	U.S.S.	S.A.E.
7/16 in. and smaller	..	64
½ in. and smaller	62	..
½ in. through 1 in.	..	60
9/16 to 1 in.	59	..
1⅛ in. through 1½ in.	57	58
1⅝ in. and larger	56	..

In full container lots, 10 per cent additional discount.

Stove Bolts

Packages, nuts loose	71 and 10
In packages, with nuts attached	71
In bulk	80

On stove bolts freight allowed up to 65c. per 100 lb. based on Cleveland, Chicago, New York on lots of 200 lb. or over.

Large Rivets *(½ in. and larger)*

	Base per 100 lb.
F.o.b. Pittsburgh, Cleveland, Chicago, Birmingham	$3.75

Small Rivets *(7/16 in. and smaller)*

	Per Cent Off List
F.o.b. Pittsburgh, Cleveland, Chicago, Birmingham	65 and 5

Cap and Set Screws

	Per Cent Off List
Upset full fin. hexagon head cap screws, coarse or fine thread, up to and incl. 1 in. x 6 in.	64
Upset set screws, cup and oval points	71
Milled studs	46
Flat head cap screws, listed sizes	36
Filister head cap, listed sizes	51

Freight allowed up to 65c. per 100 lb. based on Cleveland, Chicago or New York on lots of 200 lb. or over.

RAILS, TRACK SUPPLIES

(F.o.b. Mill)

Standard rails, heavier than 60 lb., No. 1 O.H., gross ton	$40.00
Angle bars, 100 lb.	2.70
(F.o.b. Basing Points)	*Per Gross Ton*
Light rails (from billets)	$40.00
Light rails (from rail steel)	39.00
	Base per Lb.
Cut spikes	3.00c.
Screw spikes	5.15c.
Tie plates, steel	2.15c.
Tie plates, Pacific Coast	2.30c.
Track bolts	4.75c.
Track bolts, heat treated, to railroads	5.00c.
Track bolts, jobbers discount	63-5

Basing points, light rails—Pittsburgh, Chicago, Birmingham; spikes and tie plates—Pittsburgh, Chicago, Portsmouth, Ohio, Weirton, W. Va., St. Louis, Kansas City, Minnequa, Colo., Birmingham and Pacific Coast ports; tie plates alone—Steelton, Pa., Buffalo; spikes alone—Youngstown, Lebanon, Pa., Richmond.

ROOFING TERNE PLATE

(F.o.b. Pittsburgh, 112 Sheets)

	20x14 in.	20x28 in.
8-lb. coating I.C.	$6.00	$12.00
15-lb. coating I.C.	7.00	14.00
20-lb. coating I.C.	7.50	15.00

PRICES

ELECTRICAL SHEETS

(Base, f.o.b. Pittsburgh)

	Per Lb.
Field grade	3.20c.
Armature	3.55c.
Electrical	4.05c.
Motor	4.95c.
Dynamo	5.65c.
Transformer 72	6.15c.
Transformer 65	7.15c.
Transformer 58	7.65c.
Transformer 52	8.45c.

F.o.b. Granite City, add 10c. per 100 lb. on field grade to and including dynamo. Pacific ports add 75c. per 100 lb. on all grades.

WIRE PRODUCTS

To the trade, f.o.b. Pittsburgh, Chicago, Cleveland, Birmingham

	Base per Keg
Standard wire nails	$2.55
Coated nails	2.55
Cutnails, carloads	3.85
	Base per 100 Lb.
Annealed fence wire	$3.05
Annealed galvanized fence wire	3.40
	Base Column
Woven wire fence*	67
Fence posts (carloads)	69
Single loop bale ties	59
Galvanized barbed wire†	70
Twisted barbless wire	70

*15½ gage and heavier. †On 80-rod spools in carload quantities.

WELDED PIPE AND TUBING

Base Discounts, f.o.b. Pittsburgh District and Lorain, Ohio, Mills

(F.o.b. Pittsburgh only on wrought pipe)
Base Price—$200 per Net Ton

Steel (Butt Weld)

	Black	*Galv.*
½ in.	63½	51
¾ in.	66½	55
1 to 3 in.	68½	57½

Wrought Iron (Butt Weld)

½ in.	25	3½
¾ in.	30	10
1 and 1¼ in.	34	16
1½ in.	38	18½
2 in.	37½	18

Steel (Lap Weld)

2 in.	61	49½
2½ and 3 in.	64	52½
3½ to 6 in.	66	54½

Wrought Iron (Lap Weld)

2 in.	30½	12
2½ to 3½ in.	31½	14½
4 in.	33½	18
4½ to 8 in.	32½	17

Steel (Butt, extra strong, plain ends)

	Black	*Galv.*
½ in.	61½	50½
¾ in.	65½	54½
1 to 3 in.	67	57

Wrought Iron (Same as Above)

½ in.	25	6
¾ in.	31	12
1 to 2 in.	38	19½

Steel (Lap, extra strong, plain ends)

2 in.	59	48½
2½ and 3 in.	63	52½
3½ to 6 in.	66½	56

Wrought Iron (Same as Above)

2 in.	33½	15½
2½ to 4 in.	39	22½
4½ to 6 in.	37½	21

On butt weld and lap weld steel pipe jobbers are granted a discount of 5%. On less-than-carload shipments prices are determined by adding 25 and 30% and the carload freight rate to the base card.

F.o.b. Gary prices are two points lower discount or $4 a ton higher than Pittsburgh or Lorain on lap weld and one point lower discount, or $2 a ton higher on all butt weld.

PIG IRON

All prices set in bold face type are maxima established by OPA on June 24, 1941. Other domestic prices (in italics) are delivered quotations per gross ton computed on the basis of the official maxima. Delivered prices do not reflect 3 per cent tax on freight rates.

	No. 2 Foundry	Basic	Bessemer	Malleable	Low Phos-phorus	Charcoal
Boston††	*$25.50*	*$25.00*	*$26.50*	*$25.50*	.....	.....
Brooklyn	*27.50*	.....	.....	*28.00*	.....	.....
Jersey City	*26.53*	*26.03*	*27.53*	*27.03*	.....	.....
Philadelphia	*25.84*	*25.34*	*26.84*	*26.34*	*$30.74*	.....
Bethlehem, Pa.	25.00	24.50	26.00	25.50	.....	.....
Everett, Mass.††	25.00	24.50	26.00	25.50	.....	.....
Swedeland, Pa.	25.00	24.50	26.00	25.50	.....	.....
Steelton, Pa.	.....	24.50	.....	.....	29.50	.....
Birdsboro, Pa.	25.00	24.50	26.00	25.50	29.50	.....
Sparrows Point, Md.	25.00	24.50	.....	.....	.....	.....
Erie, Pa.	24.00	23.50	25.00	24.50	.....	.....
Neville Island, Pa.	24.00	23.50	24.50	24.00	.....	.....
Sharpsville, Pa.*	24.00	23.50	24.50	24.00	.....	.....
Buffalo	24.00	23.00	25.00	24.50	29.50	.....
Cincinnati, Ohio	*23.94*	*23.94*	.....	*25.11*	.....	.....
Canton, Ohio	*25.39*	*24.89*	*25.89*	*25.39*	*32.69*	.....
Mansfield, Ohio	*25.94*	*25.44*	*26.44*	*25.94*	*32.86*	.....
St. Louis	*24.50*	*24.50*	.....	.....	.....	.....
Chicago	24.00	23.50	24.50	24.00	*35.46*	.....*$31.34*
Granite City, Ill.	24.00	23.50	24.50	24.00	.....	.....
Cleveland	24.00	23.50	24.50	24.00	*32.42*	.....
Hamilton, Ohio	24.00	23.50	.....	24.00	.....	.....
Toledo	24.00	23.50	24.50	24.00	.....	.....
Youngstown*	24.00	23.50	24.50	24.00	*32.42*	.....
Detroit	24.00	23.50	24.50	24.00	.....	.....
Lake Superior fc.	.....	.....	.....	.....	.....	$34.00
Lyles, Tenn. fc.†	.....	.....	.....	.....	.....	33.00
St. Paul	*26.76*	.....	*27.26*	*26.76*	*39.80*	.....
Duluth	24.50	24.00	25.00	24.50	.....	.....
Birmingham	20.38	19.00	25.00	.....	.....	.....
Los Angeles	*26.95*	.....	.....	.....	.....	.....
San Francisco	*26.95*	.....	.....	.....	.....	.....
Seattle	*26.95*	.....	.....	.....	.....	.....
Provo, Utah	[22.00	21.50	.....	.....	.....	.....
Montreal	*27.50*	*27.50*	.....	*28.00*	.....	.....
Toronto	*25.50*	*25.50*	.....	*26.00*	.....	.....

GRAY FORGE IRON: Valley or Pittsburgh furnace $23.50

*Pittsburgh Coke & Iron Co. (Sharpsville, Pa., furnace only) and the Struthers Iron and Steel Co., Struthers, Ohio, may charge 50c. a ton in excess of basing point prices for No. 2 foundry, basic, bessemer and malleable.

**Pittsburgh Ferromanganese Co. (Chester furnace only) may charge $2.25 a ton over maximum basing point prices.

†Price shown is for low-phosphorous iron; high-phosphorous sells for $28.50 at the furnace.

††Eastern Gas & Fuel Associates, Boston, is permitted to sell pig iron produced by its selling company, Mystic Iron Works, Everett, Mass., at $2 per gross ton above maximum prices.

Delta Chemical & Iron Co., Chicago, may charge $30 for charcoal iron at its Delta, Mich., furnace.

Basing point prices are subject to switching charges; silicon differentials (not to exceed 50c. a ton for each 0.25 per cent silicon content in excess of base grade which is 1.75 per cent to 2.25 per cent); phosphorous differentials, a reduction of 38c. per ton for phosphorous content of 0.70 per cent and over; manganese differentials, a charge not to exceed 50c. per ton for each 0.50 per cent manganese content in excess of 1.00 per cent. Effective March 3, 1943, $2 per ton extra may be charged for 0.5 to 0.75 per cent nickel content and $1 per ton extra for each additional 0.25 per cent nickel.

METAL POWDERS

Prices are based on current market prices of ingots plus a fixed figure. For ton lots f.o.b. shipping point, in cents per lb.

Copper, electrolytic, 150 and 200 mesh	21⅛ to 23⅛c.
Copper, reduced, 150 and 200 mesh	20½ to 25½c.
Iron, commercial, 100 and 200 mesh	13½ to 15c.
Iron, crushed, 200 mesh and finer	40c.
Iron, hydrogen reduced, 300 mesh and finer	63c.
Iron, electrolytic, unannealed, coarser than 300 mesh	30 to 33c.
Iron, electrolytic, annealed minus 100 mesh	42c.
Iron, carbonyl, 300 mesh and finer	90c.
Aluminum, 100 and 200 mesh.	*23 to 27c.
Antimony, 100 mesh	20.6c.
Cadmium, 100 mesh	$1
Chromium, 150 mesh	$1.03
Lead, 100, 200 & 300 mesh,	11½ to 12½c.
Manganese, 150 mesh	51c.
Nickel, 150 mesh	51½c.
Solder powder, 100 mesh,	8½c. plus metal
Tin, 100 mesh	58¾c.

*Freight allowed east of Mississippi.

BOILER TUBES

Seamless Steel and Lap Weld Commercial Boiler Tubes and Locomotive Tubes, Minimum Wall. Net base prices per 100 ft. f.o.b. Pittsburgh, in carload lots.

	Seamless Cold Drawn	Seamless Hot Rolled	Lap Weld. Hot Rolled
2 in. o.d. 13 B.W.G.	15.03	13.04	12.34
2½ in. o.d. 12 B.W.G.	20.21	17.54	16.58
3 in. o.d. 12 B.W.G.	22.48	19.50	18.35
3½ in. o.d. 11 B.W.G.	28.37	24.62	23.15
4 in. o.d. 10 B.W.G.	35.20	30.54	28.66

(Extras for less carload quantities)

40,000 lb. or ft., and over	Base
30,000 lb. or ft. to 39,999 lb. or ft.	5%
20,000 lb. or ft. to 29,999 lb. or ft.	10%
10,000 lb. or ft. to 19,999 lb. or ft.	20%
5,000 lb. or ft. to 9,999 lb. or ft.	30%
2,000 lb. or ft. to 4,999 lb. or ft.	45%
Under 2,000 lb. or ft.	65%

PRICES

SEMI-FINISHED STEEL

Billets, Blooms and Slabs

Pittsburgh, Chicago, Gary, Cleveland, Youngstown, Buffalo, Birmingham, Sparrows Point (rerolling only). Prices delivered Detroit are $2.00 higher; f.o.b. Duluth, billets only, $2.00 higher; billets f.o.b. Pacific ports are $12 higher. Delivered prices do not reflect new three per cent tax on freight rates.

	Per Gross Ton
Rerolling	$34.00
Forging quality	40.00
Alloy steel: Pittsburgh, Chicago, Canton, Massillon, Buffalo, or Bethlehem, per gross ton	$54.00

Shell Steel

	Per Gross Ton
3 in. to 12 in.	$52.00
12 in. to 18 in.	54.00
18 in. and over	56.00

Basic open hearth shell steel, f.o.b. Pittsburgh, Chicago, Buffalo, Gary, Cleveland, Youngstown and Birmingham. Prices delivered Detroit are $2.00 higher.

Note: The above base prices apply on lots of 1000 tons of a size and section to which are to be added extras for chemical requirements, cutting, or quantity.

Sheet Bars

Pittsburgh, Chicago, Cleveland, Youngstown, Buffalo, Canton, Sparrows Point, Md.

	Per Gross Ton
Open hearth or bessemer	$34.00

Skelp

Pittsburgh, Chicago, Youngstown, Coatesville, Pa., Sparrows Point, Md.

	Per Lb.
Grooved, universal and sheared	1.90c.

Wire Rods

(No. 5 to 9/32 in.)

	Per Lb.
Pittsburgh, Chicago, Cleveland	2.00c.
Worcester, Mass.	2.10c.
Birmingham	2.00c.
San Francisco	2.50c.
Galveston	2.25c.

9/32 in. to 47/64 in., 0.15c. a lb. higher. Quantity extras apply.

TOOL STEEL

(F.o.b. Pittsburgh, Bethlehem, Syracuse)

	Base per lb.
High speed	67c.
Straight molybdenum	54c.
Tungsten-molybdenum	57½c.
High-carbon-chromium	43c.
Oil hardening	24c.
Special carbon	22c.
Extra carbon	18c.
Regular carbon	14c.

Warehouse prices east of Mississippi are 2c. a lb. higher; west of Mississippi 3c. higher.

CORROSION AND HEAT-RESISTING STEEL

(Per lb. base price, f.o.b. Pittsburgh)

Chromium-Nickel Alloys

	No. 304	No. 302
Forging billets	21.25c.	20.40c.
Bars	25.00c.	24.00c.
Plates	29.00c.	27.00c.
Structural shapes	25.00c.	24.00c.
Sheets	36.00c.	34.00c.
Hot rolled strip	23.50c.	21.50c.
Cold rolled strip	30.00c.	28.00c.
Drawn wire	25.00c.	24.00c.

Straight-Chromium Alloys

	No. 410	No. 430	No. 442	No. 446
F.Billets	15.725c.	16.15c.	19.125c.	23.375c.
Bars	18.50c.	19.00c.	22.50c.	27.50c.
Plates	21.50c.	22.00c.	25.50c.	30.50c.
Sheets	26.50c.	29.00c.	32.50c.	36.50c.
Hot strip	17.00c.	17.50c.	24.00c.	35.00c.
Cold strip	22.00c.	22.50c.	32.00c.	52.00c.

Chromium-Nickel Clad Steel (20%)

	No. 304
Plates	18.00c.*
Sheets	19.00c.

*Includes annealing and pickling.

PRICES

Ferromanganese

78-82% manganese, maximum contract base price per gross ton, lump size, f.o.b. car at Baltimore, Philadelphia, New York, Birmingham, Rockdale, Rockwood, Tenn.

Carload lots (bulk)	$135.00
Ton lots (packed)	141.00
Less ton lots (packed)	148.50

Premium, $1.70 for each 1% above 82% Mn; penalty, $1.70 for each 1% below 78%.

Electrolytic Manganese

99.9% manganese, maximum base contract price per lb. of metal, bulk, f.o.b. shipping point, with freight allowed to destination. Size, 1" x D.

	Eastern Zone	Central Zone	Western Zone
Carload lots	37.60c.	37.85c.	38.15c.
l.c.l. lots	39.60c.	38.60c.	40.65c.

Spiegeleisen

Maximum base contract prices, per gross ton, lump, f.o.b. Palmerton, Pa.

	16-19% Mn 1% max. Si	19-21% Mn 1% max. Si	26-28% Mn 1% max. Si
Carloads	$35.00	$36.00	$49.50
Less ton*	47.50	48.50	62.00

Electric Ferrosilicon

OPA maximum base price cents per lb. contained Si, lump size in carlots, f.o.b. shipping point with freight allowed to destination.

	Eastern Zone	Central Zone	Western Zone
50% silicon	6.65c.	7.10c.	7.25c.
75% silicon	8.05c.	8.20c.	8.75c.

Spot sales 45c. per lb. higher for 50% Si; 30c. for 75% Si. For extras and premiums see MPR 405.

Silvery Iron

(*Per Gross Ton, base 6.00 to 6.50 Si*)

F.o.b. Jackson, Ohio	$29.50*
Buffalo	30.75*

For each additional 0.50% silicon add $1 a ton. For each 0.50% manganese over 1% add 50c. a ton. Add $1 a ton for 0.75% phosphorus or over.

*Official OPA price established June 24, 1941.

Bessemer Ferrosilicon

Prices are $1 a ton above silvery iron quotations of comparable analysis.

Silicon Metal

OPA maximum base price per lb. of contained Si, lump size, f.o.b. shipping point with freight allowed to destination, for l.c.l. above 2000 lb., packed.

	Eastern Zone	Central Zone	Western Zone
96% Si, 2% Fe.	13.10c.	13.55c.	16.50c.
97% Si, 1% Fe.	13.45c.	13.90c.	16.90c.

Ferrosilicon Briquets

OPA maximum base price per lb. of briquet, bulk, f.o.b. shipping point with freight allowed to destination. Approximately 40% silicon.

	Eastern Zone	Central Zone	Western Zone
Car lots	3.35c.	3.50c.	3.65c.

Spot prices ¼c. higher per lb. of briquet. For premiums and extras see MPR 405.

Silicomanganese

(*Per gross ton, delivered, carloads, bulk*)

3.00 carbon	$120.00*
2.50 carbon	125.00*
2.00 carbon	130.00*
1.00 carbon	140.00*
Briquets, contract, basis carlots, bulk freight allowed, per lb.	5.30c.†
Packed	6.05c.†
Less ton lots	6.55c.†

*Spot prices are $5 per ton higher.
†Spot prices ¼c. higher.

Ferrochrome

(65-72% *Cr*, 2% *max. Si*)

OPA maximum base contract prices per lb. of contained Cr, lump size in carlots, f.o.b. shipping point, freight allowed to destination.

	Eastern Zone	Central Zone	Western Zone
0.03% carbon	25.00c.	25.40c.	26.00c.
0.06% carbon	23.00c.	23.40c.	24.00c.
0.10% carbon	22.50c.	22.90c.	23.50c.
1.00% carbon	20.50c.	20.90c.	21.50c.
2.00% carbon	19.50c.	19.90c.	20.50c.

Spot prices are ¼c. higher per lb. contained Cr. For extras and premiums see MPR 407.

Other Ferroalloys

Ferrotungsten, delivered, carlots, per lb. contained tungsten	$1.90
Tungsten metal powder, 98%-99%, any quantity, per lb.	$2.60
Ferrovanadium, 35%-40%, contract basis, f.o.b. producers plant, usual freight allowances, open-hearth grade, per lb. contained vanadium	$2.70
Special grade	$2.80
Very special grade	$2.90
Vanadium pentoxide, 88%-92% V_2O_5 technical grade, contract basis, any quantity, per lb. contained V_2O_5	$1.10
Ferroboron, contract basis, 17.50% boron minimum, f.o.b. Niagara Falls, carlots, per lb. alloy	$1.20
Ton lots	$1.25
Silcaz No. 3, contract basis, f.o.b. Niagara Falls, all quantities, per lb. of alloy	23c.
Silvaz No. 3, contract basis, f.o.b. Niagara Falls, all quantities, per lb. of alloy	40c.
Grainal, f.o.b. Bridgeville, Pa., freight allowed 100 lb. and over, maximum based on rate to St. Louis, per lb.	45c.
Bortam, f.o.b. Niagara Falls	
Ton lots, per lb.	45c.
Less ton lots, per lb.	50c.
Borosil, 3% to 4% boron, 40 to 45% silicon, f.o.b. Philo, Ohio, per lb. contained boron	$7.00
Ferrocolumbium, 50% to 60%, f.o.b. Niagara Falls, ton lots, per lb. contained columbium	$2.25
Less ton lots	$2.30
Ferrotitanium, 40%-45%, f.o.b. Niagara Falls, N. Y., ton lots, per lb. contained titanium	$1.23
Less ton lots	$1.25
Ferrotitanium, 20%-25%, 0.10 C max., ton lots, per lb. contained titanium	$1.35
Less ton lots	$1.40
High-carbon ferrotitanium, 15%-20%, 6%-8% carbon, contract basis, f.o.b. Niagara Falls, N. Y., freight allowed East of Mississippi River, North of Baltimore and St. Louis, per gross ton	$142.50
3%-5% carbon	$157.50
Ferrophosphorus, 18% electric or blast furnace, f.o.b. Anniston, Ala., carlots, with $3 unitage freight equaled with Rockdale, Tenn., per gross ton	$58.50
Ferrophosphorus, electrolytic 23-26%, carlots, f.o.b. Monsanto (Siglo), Tenn., $3 unitage freight equalized with Nashville, per gross ton	$75.00
Ferromolybdenum, 55-75 per cent, f.o.b. Langeloth and Washington, Pa., any quantity, per lb. contained molybdenum	95c.
Calcium molybdate, 40%-45%, contract basis, f.o.b. Langeloth and Washington, Pa., any quantity, per lb. contained molybdenum	80c.
Molybdenum oxide briquettes, 48%-52% Mo, f.o.b. Langeloth, Pa., per lb. contained Mo	80c.
Molybdenum oxide, in cans, f.o.b. Langeloth and Washington, Pa., per lb. contained Mo	80c.
Molybdenum powder, 99%, in 200-lb. kegs, f.o.b. York, Pa., per lb.	$2.60
Under 100 lb.	$3.00
Zirconium, 35-40%, contract basis, carloads in bulk or package, per lb. of alloy	15c.
Less ton lots	16c.
Zirconium, 12-15%, contract basis, carlots, bulk, per gross ton	$102.50
Packed	$107.50
Less ton lots	$112.50
Alsifer (approx. 20% Al, 40% Si and 40% Fe), contract basis, f.o.b. Niagara Falls, per lb.	7.50c.
Ton lots	8c.
Simanal (approx. 20% Si, 20% Mn, 20% Al), contract basis, carlots, f.o.b. Phila., Ohio, per lb. ton lots	9.50c.
Less ton lots	10.50c.

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